

NOVEMBER, 1950

Shop Overhead
**Radio-Television
SERVICE
DEALER**



The Professional Radio-TVman's Magazine

IN THIS ISSUE:

Time Multiplex Transmission
Know the Cathode Ray Tube, Part 2
Front Ends, Part 5
Electrical Requirements of Tape Recorders
Construction and Operation of a Cable Spinner
Lightning Strikes a TV Antenna
Shop Overhead Analysis
The C.B.S. System of Color TV
A Studio for Servicemen

AM-FM-TV-SOUND

Paid Circulation Of This Issue: Over: 25,000

Total Distribution Of This Issue: Over: 30,000

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RG-5/U

APTITUDE RATING No. 8236

Frequency (Mc)	Attenuation per 100 ft
100.	2.65
200.	3.85
300.	4.80
400.	5.60

RG-8/U

APTITUDE RATING No. 8237

Frequency (Mc)	Attenuation per 100 ft
100.	2.10
200.	3.30
300.	4.10
400.	4.50

RG-11/U

APTITUDE RATING No. 8238

Frequency (Mc)	Attenuation per 100 ft
100.	1.90
200.	2.85
300.	3.60
400.	4.35

RG-54A/U

APTITUDE RATING No. 8239

Frequency (Mc)	Attenuation per 100 ft
100.	2.90
200.	4.20
300.	5.50
400.	6.70

RG-59/U

APTITUDE RATING No. 8241

Frequency (Mc)	Attenuation per 100 ft
100.	3.75
200.	5.60
300.	7.10
400.	8.30

For use with television antenna.

RG-58/U

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Frequency (Mc)	Attenuation per 100 ft
100.	4.10
200.	6.20
300.	8.00
400.	9.50

For use with radio frequency transmission, video, test equipment, and pulse transmission.

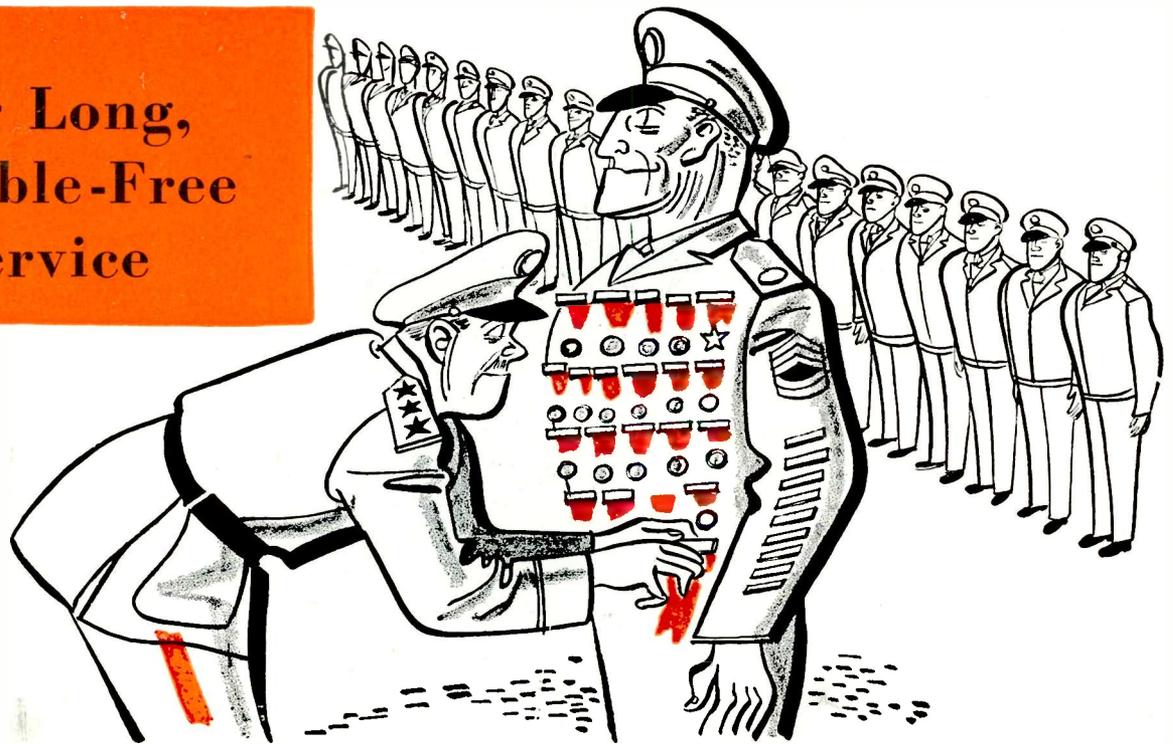
You know what you are doing when you use Belden RG/U Transmission Line Cables—they're aptitude rated. They are designed from the start to provide desirable electrical characteristics, and rigid manufacturing control assures constant, unwavering quality. You can safely put Belden Wire to work for you, and know for sure how it will perform. You can know, too, that it will have the stamina to stay loyally on the job for years. For trouble-free installations, specify Belden Radio Wires.

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Radio WIRE

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P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

EDITORIAL

by S. R. COWAN

Color TV Fiasco

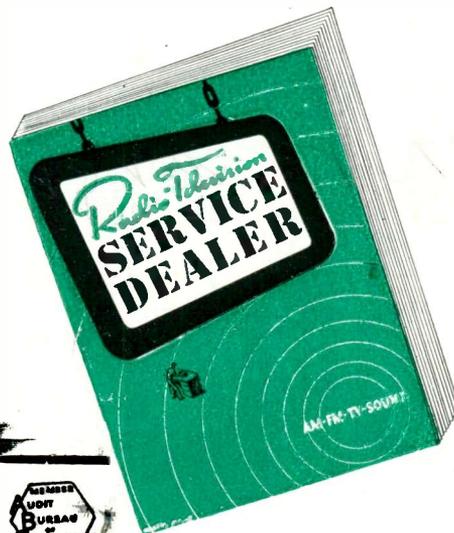
FCC's decision to approve the CBS mechanical system of color telecasting rather than wait until a compatible electronic method worthy of adaptation comes along is, to say the least, regrettable. Only CBS and a few insignificant equipment manufacturers seem pleased by the FCC edict, while every important factor in the trade opposes it. In fact, several major TV manufacturers have already taken the preliminary legal steps necessary to enjoin both CBS and FCC from carrying out their venture. Our legal counsel is of the opinion that one or more of them will succeed in winning either a temporary or permanent injunction, and that FCC's "boss", the Senate Committee on Interstate Commerce, will also step in and see to it that Commission reverses itself before too much damage is done.

Servicing Color TV

The servicing profession knows that it still has much to learn about the complexities of TV in its black and white state. About color TV practically nothing is known, and in handling color TV by means of mechanical gadgets one must add a knowledge of machinery to his stock of technical circuitry know-how. We would be remiss in our obligations as educators were we to neglect this fact and thus, whether or not the CBS color system ever becomes a *fait accompli*, we will immediately begin to cover the subject in all its phases.

To all outward appearances we, in the servicing field, would welcome any development that would force the TVset owning public to come to us and spend money for our services. Such is not the case, however, where the CBS color TV system is concerned, because actually only a minute number of TVset owners would be willing to invest money on conversion now—after all the adverse publicity. The public will wait to see what's going to happen. Meanwhile, we are being hurt financially because a great many people who were about to buy TVsets have now also decided to bide a while. This factor is giving some joy to component and tube suppliers who are so far behind in deliveries that they welcome anything that will give them time in which to catch up. At the same time certain "hoarders" are beginning to get green around the gills, and suddenly we find the tube situation loosening up.

The serious shortage of many components and accessories is the service profession's big heartache right now. Thousands of defective AM and TV receivers are on benches lying idle because tubes and parts needed for their repair are not available. And in fringe areas thousands of receivers which require boosters and stacked arrays are also idle because installations cannot be finished without either the boosters or the transmission line needed for high mast drops.



Sanford R. Cowan
EDITOR & PUBLISHER

Samuel L. Marshall
MANAGING EDITOR

COWAN PUBLISHING Corp
342 MADISON AVENUE
NEW YORK 17, N. Y.

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SANFORD L. CAHN

Advertising Director

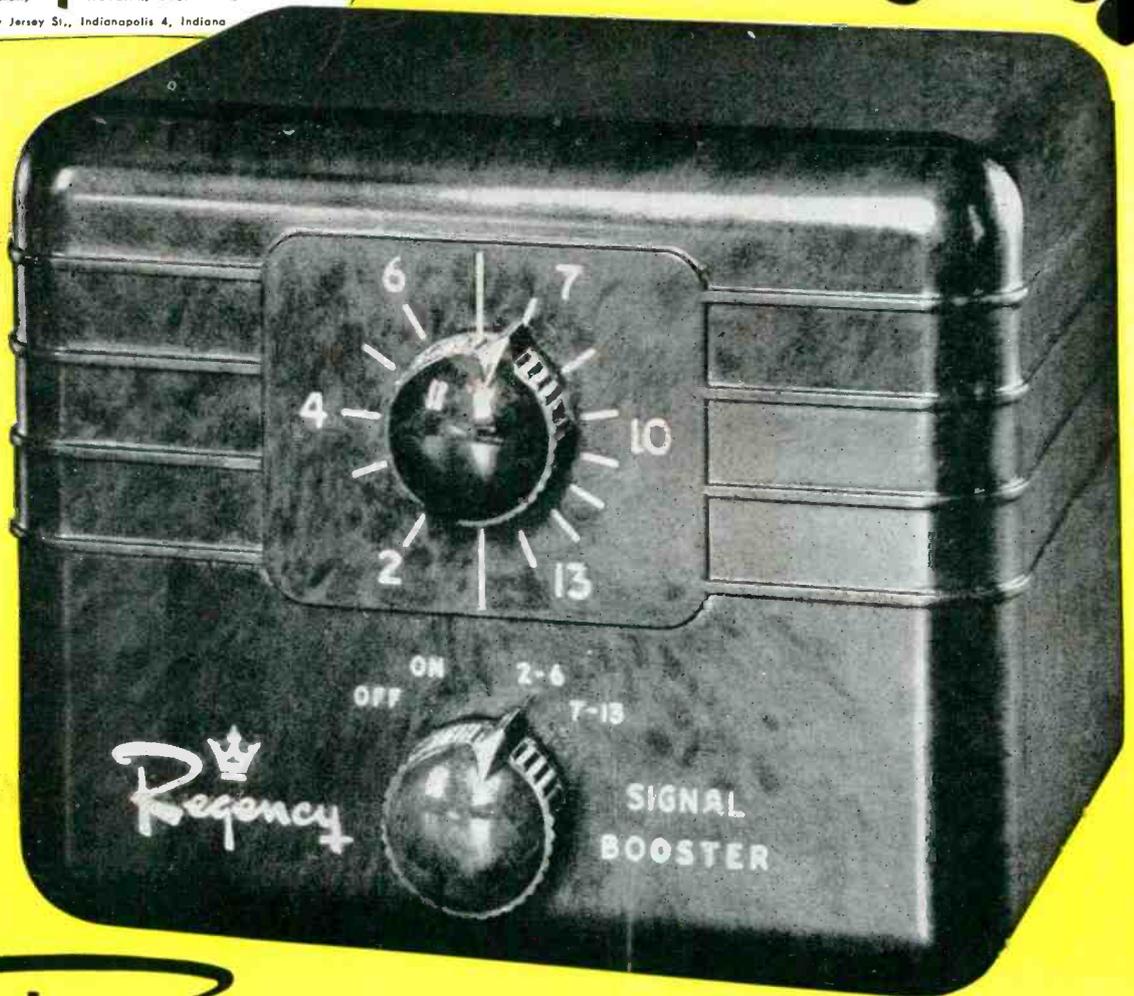
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Regency

THE DB 400
LIST \$32.50

IN BLONDE FINISH AT \$37.50

TV IS THE LARGEST SELLING SIGNAL BOOSTER!

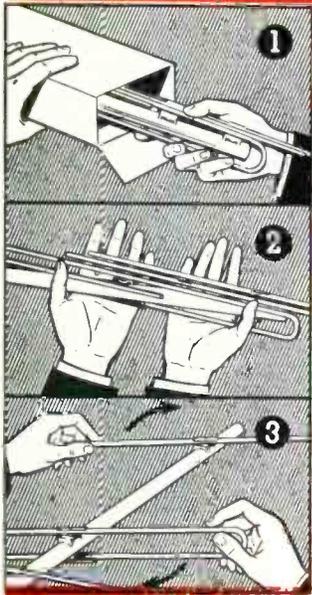
BECAUSE . . . Regency wins all performance tests in nationally-known laboratories . . . Regency is the lowest priced **QUALITY** Television Signal Booster . . . Regency offers such features as simplified tuning control; easy installation; full coverage on all 12 channels . . . and Regency is UNDERWRITERS'  APPROVED.

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SIMPLE!!!

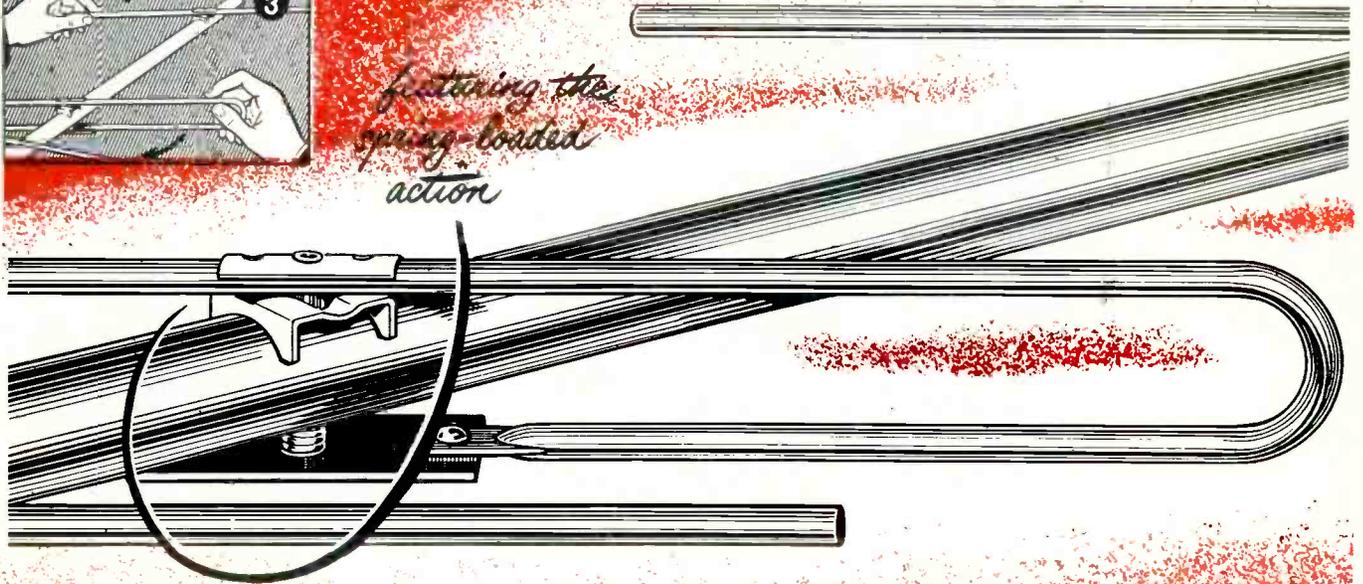
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to set up!

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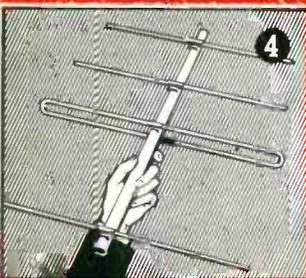


NOTHING TO TIGHTEN...
NOTHING TO LOOSEN!

*featuring the
spring-loaded
action*



ANTENNA ASSEMBLES IN 1 SECOND!



- Costs dollars less than any other antenna to install.
- Can be carried to mast in folded-up condition and opened with one hand in 1 second.
- Guaranteed permanence when installed – no screws or nuts to lose or loosen.
- The combination of Click-Rig construction and the TACO name means electrical and mechanical perfection as it has for the past 17 years.
- **ASK YOUR JOBBER FOR THE BRAND-NEW 1950 TACO CATALOGS**

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ANTENNA SYSTEMS
TECHNICAL APPLIANCE CORPORATION,
SHERBURNE, N. Y.

TACO

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CO. LTD.
TORONTO 4, ONT.

RADIO-TELEVISION SERVICE DEALER • NOVEMBER, 1950

FOY ELECTRIC COMPANY, INC.

305 SOUTH MINT STREET TELEPHONE 3-4834

CHARLOTTE 6, N. C.



August 21, 1950

Hytron Radio & Electronics Corp.,
Salem, Mass.

Dear Sirs:

It is with great pleasure that I write you at this time to compliment you on the superior performance of the Hytron 16RP4 cathode ray picture tube.

I have just purchased one of the NEW _____ 16" table model television sets, model _____, for my own personal use. I was not pleased with the brown spot which is often found in the rectangular tubes so I replaced this new _____ picture tube with one of Hytron's. The result? Amazing! Actually clearer and sharper pictures, more brilliance and no brown spot.

We are authorized service for about 11 different makes of TV sets and _____ is one of the factories we serve. From now on we shall insist upon Hytron for all picture tube replacements.

Yours truly,

J. A. Gupton, Jr.
Service Dept. Manager

WHY MR. GUPTON PREFERS

HYTRON RECTANGULARS

Thanks to Mr. Gupton. His unsolicited appreciation naturally warms our heart. More important, he gives all service-dealers an excellent reason for picking Hytron rectangulars.

Does he choose Hytron: Because the rectangular is Hytron's baby . . . the original leader? Because Hytron's picture-tube plant is the most modern in the country? Because nine out of ten leading TV set makers choose Hytron? Because more and more service-dealers show equal shrewdness?

He has an even better reason: experience. His own experience proves Hytron better. Hytron rectangulars give him amazingly clearer, sharper, more brilliant pictures. They'll do the same for you. Demand original Hytron rectangulars. Prove by your own tests that Hytron is also *your* best choice.

16RP4 Rectangular



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PREMIUM QUALITY AT NO EXTRA COST

Sprague Black Beauty Telecap® Tubulars are different from and superior to every other molded paper capacitor because they are made by the same dry assembly process as large metal-encased oil capacitors. They cannot be contaminated by dust or moisture during manufacture.

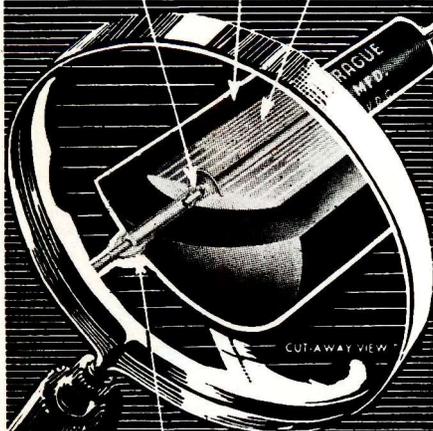
Ask for Black Beauty Telecaps at your jobber's.

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Non-flammable,
dense bakelite
phenolic-molded
housing

Hollow eyelet terminal for oil impregnation after molding

Uniform windings of high purity paper and aluminum foil



Solder seal as in large metal-encased oil capacitors

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(Distributors' Division of Sprague Electric Co.)

71 Marshall Street
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TRADE FLASHES

A "press-time" digest of production,
distribution & merchandising activities

New Merchandizing Policy

Webster-Chicago Corporation has announced a new policy designed to protect dealers from loss of business through preferential price discounts to consumers who should be paying the full retail price.

The firm, which manufactures magnetic recorders, record-changers and phonographs, has informed its distributors that all catalogs, advertisements and other announcements directed to the general public should carry full retail prices. W. S. Hartford, vice-president in charge of sales, said the firm recognizes that in the field of radio and electronics, amateurs, experimenters and others have enjoyed preferential price discounts. In some cases, however, Hartford pointed out, these discounts have been given to consumers who ordinarily would buy from an authorized dealer at full retail price. Where discount prices intended only for technicians and other specialized buyers are listed in catalogs along with the retail price, this cannot be avoided, Hartford said, so the practice will be eliminated.

In order to protect the price structure on Webster-Chicago products, Webster-Chicago will continue its policy of approving advance proofs of catalogs and other written announcements before publication.

For the specialized buyers—experimenters, engineers, industrial users and others—a preferential price considerably above the dealer price is recommended by the company. Hartford pointed out that this preferential consideration should apply only to component parts and not to any Webster-Chicago finished-line consumer products, which must be sold at list price.

Town Meeting & Committee Named

President Robert C. Sprague of the Radio-Television Manufacturers Association week named a fifteen-man "Town Meetings" Committee and reappointed Harry A. Ehle, vice president of International Resistance Co., Chairman.

The RTMA committee is currently conducting "Town Meetings" for television dealers and servicemen in television areas throughout the country. The program is being financed on a voluntary basis by TV set manufacturers.

Wall Chart

A new completely revised edition of the Sprague "Tell-U-How" wall chart for radio and television servicemen is now available from distributors of Sprague capacitors.

Beautifully lithographed in color, the 22 x 28 inch chart includes valuable service application data on capacitors, as well as descriptions of common circuit troubles and their remedies; complete color codes on all types of capacitors; transformer color codes; resistor color codes; electrical formulas, and much other useful and related service information.

This handy chart, Sprague Form M-453, may be obtained free from all Sprague distributors or by writing the Sprague Products Company, North Adams, Mass., enclosing 10 cents to cover postage and handling costs.

New Pocket Manual

Electrovox Co., Inc., of East Orange, N. J. announces that at the request of servicemen they are now offering, through parts jobbers, one of the greatest aids thus far conceived to help replacement needle servicing.

This pocket manual, compiled with the aid of an independent research agency at great cost, provides the following:

A concise, up-to-date summary of all phonos by year, model number, cartridge, needle.

A complete listing of all cartridges with drawings, model numbers, prices and installation notes on all cartridges and needles in use today.

A special selection of 13 basic needles covering better than 90% of today's replacement demand.

It is a pocket-size condensation of the famous Walco Master Control



take it from **EXPERTS**



PAT REID SAYS:

Salesmanager, United Radio Supply, Inc.
Portland and Eugene, Oregon

"Our 379 servicemen and dealers tell us N. U. tubes are best, because their own experience has proved N. U. tubes are reliable, uniform, and above all are properly designed for interchangeability. What's more, costly call-backs are minimized by N. U.'s proven quality control. That's why we've featured N. U. tubes for 15 years. They mean good business for all of us.

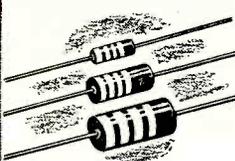
- RADIO AND TELEVISION RECEIVING TUBES
- VIDEOTRON TELEVISION PICTURE TUBES
- PANEL LAMPS
- TRANSMITTING AND SPECIAL PURPOSE TUBES



NATIONAL UNION RADIO CORP.

Main Office: 350 Scotland Rd., Orange, N. J.

Research Division: Orange, N. J. • Plants: Newark, N. J. — Hatboro, Pa.



**LITTLE DEVIL
COMPOSITION
RESISTORS**

Resistance and wattage are clearly marked on every one of these tiny, rugged insulated composition resistors. Three sizes: 1/2, 1 and 2-watt in all RMA resistances. Tolerance $\pm 5\%$ and $\pm 10\%$.

**LITTLE DEVIL
RESISTOR
ASSORTMENTS
in
Plastic Cabinet**



Selected servicemen's assortments, in rugged plastic cabinets at no extra cost. 125 Resistors: 1/2-watt, \$12.50; 1-watt, \$18.75; 2-watt, \$25.00.

**TYPE AB
POTENTIOMETER**



It's quiet! This Type AB Potentiometer has a resistance unit that's solid molded. As a result, the noise level often becomes less with use. Has a 2-watt rating, good safety factor.

Be Right with



OHMITE



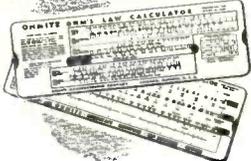
**BROWN DEVIL
WIREWOUND
RESISTORS**

Dependable vitreous-enameled units, in a size small enough to fit most installations. Easily mounted by 1 1/2" tinned wire leads. Three sizes: 5, 10, and 20 watts. Tolerance $\pm 10\%$.



**DIVIDOHM ADJUSTABLE
RESISTORS**

These wirewound resistors, with one or more adjustable lugs, provide a convenient means of obtaining odd resistance values. Stock units made in 10, 25, 50, 75, 100, 160, and 200-watt sizes, in many resistance values.



**OHM'S
LAW
CALCULATOR**

25c

Favorite of engineers everywhere! Solves Ohm's Law problems with one setting of the slide. Also has parallel resistance and slide rule scales.

Index and comes complete with the 13 basic needles.

New Antenna Book

John F. Rider Publisher, Inc., 480 Canal Street, New York 13, N. Y., announces their new all-inclusive antenna book "TV and Other Receiving Antennas" (Theory and Practice) by Arnold B. Bailey, will be available at Rider jobbers late in October.

A review is initially given of definitions of terminology used in antenna practice, an analysis of the television signal, conditions that determine signal levels at the receiver, and the problems of propagation as they relate to operations up to 1000 mc. It then goes on to antenna theory proper and the practical applications pertaining to it, making available data on approximately 50 different types of antennas and their applications. To eliminate the use of tedious mathematics, simplify reading, and save time, tables, charts, and graphs are used throughout the book. Formulae and graphs are given for cutting antennas of various thicknesses to the proper physical length for resonance, for the determination of antenna behavior at the multiple resonance points, etc.

"TV and Other Receiving Antennas" (Theory and Practice) contains 603 pages in a cloth binding, with 310 illustrations, and is thoroughly indexed. It is priced at \$6.00.

NEDA Exhibit Well Attended

2400 persons registered for the first national convention and exhibition staged by NEDA in Cleveland August 28 through the 31st. Distributors, manufacturers and manufacturers' representatives have voiced complete satisfaction with the conduct of the exhibition.

The technical sessions which began at 9:00 A.M. each morning were very well attended, and distributors felt well repaid for the time spent listening to Harold H. Bredell of the American Bar Association; Donald J. Erickson of Arthur Anderson Company; Don G. Mitchell, President Sylvania Electric Products Company; H. F. Bersche, Manager, Renewal Sales, Radio Corporation of America; Joseph T. Bellew, Analyst-Consultant, Albany, New York.

The date and location of the 1951 Convention have not yet been definitely decided on.

Cornish Wire Co. Moves

Cornish Wire Company, Inc. will move its general executive offices on October 30th, to greatly enlarged

[Continued on page 14]

You can always depend upon any "Ohmite" component to give long, trouble-free service. Every Ohmite product is designed and constructed to stand up under severe service conditions . . . to give extra performance.

When you need rheostats, resistors, tap switches, or chokes, play safe and specify OHMITE.

OHMITE MANUFACTURING CO.
4845 Flournoy Street, Chicago 44, Illinois

Write FOR
STOCK CATALOG



OHMITE RHEOSTATS
RESISTORS
TAP SWITCHES

Reg. U. S. Pat. Off.

BOOST

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ALLIANCE BOOSTER*

Tenna-Scope, like Tenna-Rotor will be backed by national TV advertising that sells! No other booster will have equal acceptance!

For Tenna-Scope is superior in design for ease of operation and performance. One control for all channels! Automatic switch turns booster on with set. Superbly styled plastic control case blends with all furniture. Exceptional high-channel reception and uniformity of picture and sound! Price \$29.95.

Actual size — 6 1/4" x 5 3/8" x 5"



2 perfect companions:

* **TENNA-SCOPE**
TENNA-ROTOR

Actual size —
 6 1/4" x 5 3/8" x 5"



New Deluxe
 Model HIR Tenna-Rotor

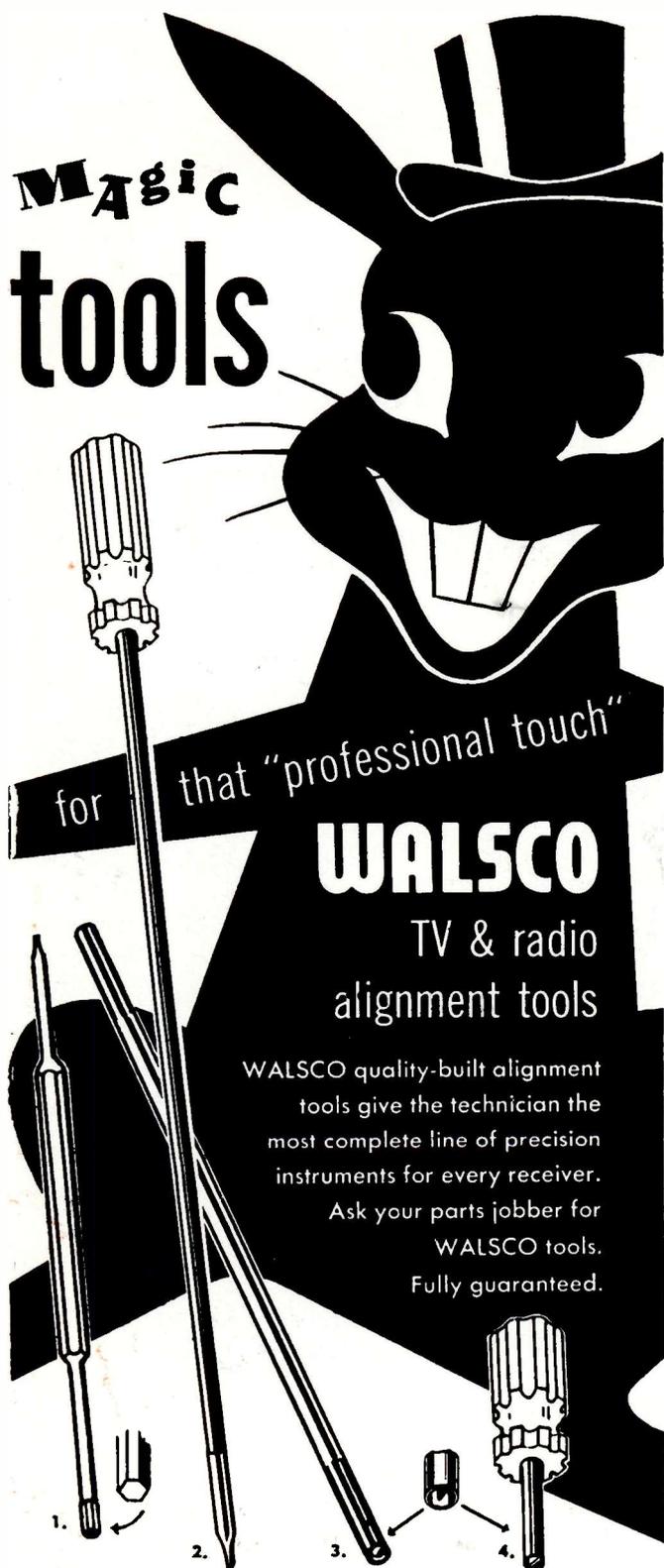
New Automatic Tenna-Rotor—Model HIR—just set the pointer—antenna then turns to that point and stops. North—East—South—West. Direction indicator dial shows exact position at all times. May be marked for present or new channels. Guaranteed for one year. Uses special "Zip" feature, 4-conductor cable for fast installation. Advertised in all major TV areas.

Just set it—and forget it!

Alliance Manufacturing Co.
 Alliance, Ohio
 Export Department: 401 Broadway, New York, N. Y., U. S. A.

alliance
TENNA · SCOPE

Magic tools

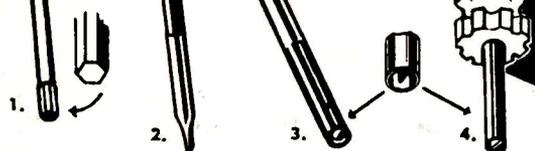


for that "professional touch"

WALSCO

TV & radio alignment tools

WALSCO quality-built alignment tools give the technician the most complete line of precision instruments for every receiver. Ask your parts jobber for WALSCO tools. Fully guaranteed.



1. Combination hex stud and small screwdriver for I.F. alignment on Zenith, Hoffman, Belmont, and similar T.V. sets. Molded of toughest, pure nylon. Catalog No. 2526.
2. Tough, extra long (12") front-end aligner for Admiral, Emerson, RCA, etc. Replaceable nylon tip. Catalog No. 2523.
3. Duplex I.F. aligner with recessed blades. One side for #6, other side for #4 studs. Unbreakable plastic. Catalog No. 2519.
4. Short (2") I.F. tool with recessed blade. Perfect for cramped quarters.

WRITE FOR WALSCO CATALOG 51

WALSCO Walter L. Schott Co., Beverly Hills, Calif. • Chicago 6, Ill.

SYNC PULSES

by San D'Arcy

Color TV—Ha Ha! There is no reason whatever why anyone should not buy any TVset of reputable make at this time if he is in the market for a TVset. Such a blunt statement, in view of all the 'confused' color TV reports now rampant, must be justified and I will attempt to do just that by quoting excerpts from the address made by Mr. R. C. Sprague, president of the Radio-TV Manufacturers Assoc. over CBS-TV Channel 2 on October 22nd.

"Let me try to answer the questions I know are in the minds of some 8,000,000 owners of TVsets, and in the minds of the additional millions who want the education and entertainment that can be brought to their homes only through TV, and who are planning to buy TVsets in the months just ahead.

"First, will black and white programs continue? Second, what programs will I get in color? Third, shall I buy a black and white set now? (The answers) Black and white TV will never be obsolete, even when a sound color system has been developed. Black and white programs will continue to provide the best TV entertainment for years to come. The advertisers who sponsor the best programs will never abandon the mass audience in favor of a smaller number of persons who will be willing to pay for color. CBS has promised it will broadcast 20 hours of color per week, but most of these broadcasts apparently will be in fringe hours when the average person is at work or asleep, and will not include the popular evening programs.

Now, that being the case, only the people who live within CBS's range in metropolitan New York are at present affected by the color TV problem. How many of them will be willing to pay upwards of \$100 for the necessary adapters and converters plus a service fee is a moot question. Further, only a few owners of large screen sets will be willing to accept small sized pictures obtainable over the CBS system. Our guess is that much ado about nothing is making potential TVset buyers hold back from purchasing sets now, and if they hold back, they will regret it. In time, an acceptable compatible color TV system will be developed, and present-day TVsets will receive such telecasts. (This answer to the third question posed by Mr. Sprague is the writer's opinion).

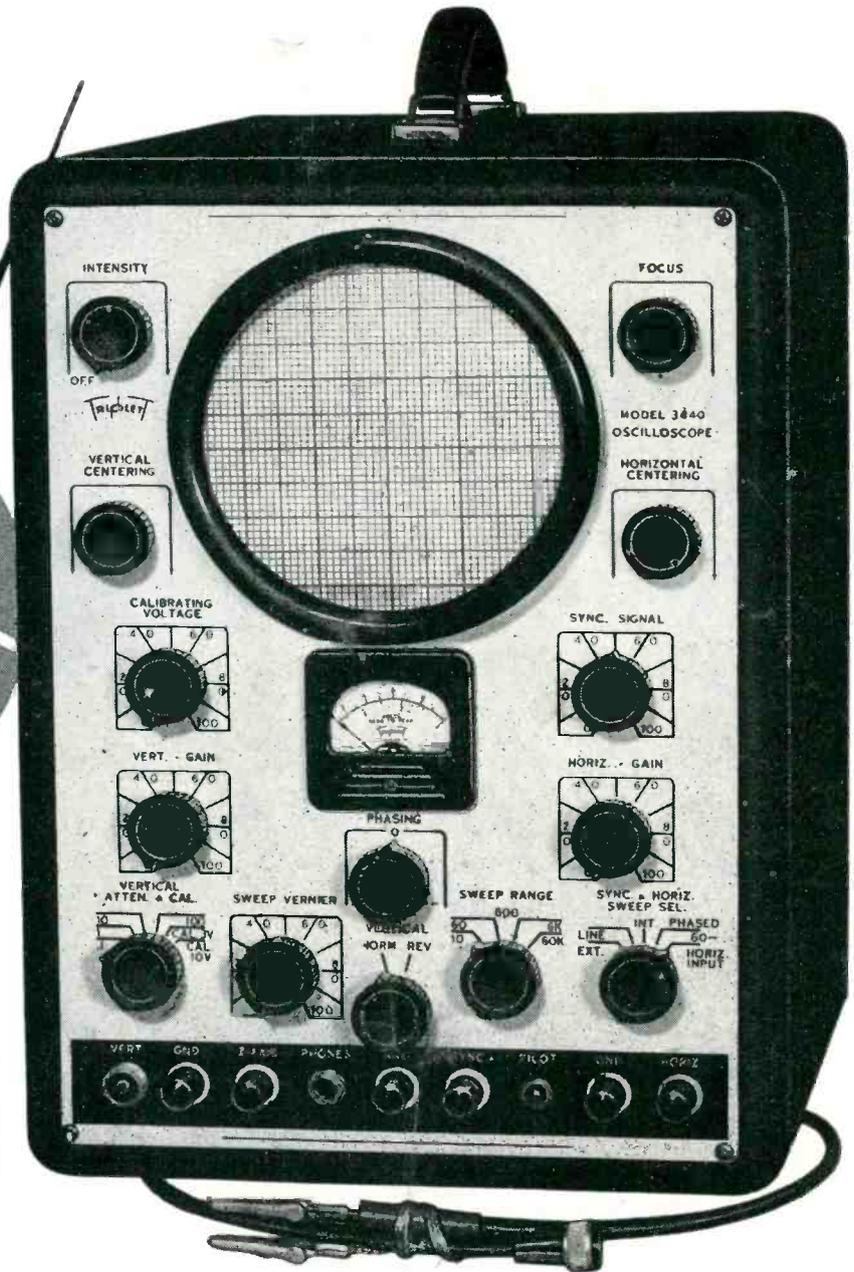
TV Production Figures. RTMA's report of production for the first 9 months of 1950 indicate that this will be the banner year in the industry. Here are the figures:

	Television	Home Radios	Auto Radios	Portable Radios
January	424,000	581,000	329,000	69,000
February	536,000	505,000	379,000	120,000
March	643,000	587,000	389,000	114,000
April	432,000	526,000	273,000	143,000
May	557,000	796,000	291,000	351,000
June	522,000	710,000	567,000	262,000
July	330,315	391,170	234,025	97,323
August	702,287	754,232	320,960	128,255
Sept.	817,157	831,837	356,388	129,070
9 Months				
Total	4,963,759	5,682,239	2,972,373	1,413,648

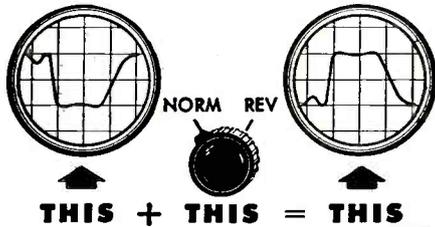
Note that TVset production for this year will exceed 6 million units, far ahead of all anticipation.



**WIDE RANGE 5-INCH
OSCILLOSCOPE
MODEL 3440**



- *● Provision for changing polarity—wave form shows in conventional manner.
- *● Calibration Meter—to measure voltage of complex wave forms in TV receivers.
- *● Vertical deflection sensitivity—.009 RMS volts/inch.
- Wide frequency range—20 cycles to 1 MC on Vertical—Services both TV & FM.
- Return trace eliminator.
- Internal phase controlled horizontal sweep.
- Internal sweep oscillator—10 to 60 KC linear.
- Z-axis input for intensity modulation.



The first oscilloscope which permits changing polarity, thus keeping wave form showing in a conventional manner.

ONLY \$189.50 AT YOUR DISTRIBUTORS

● Copper plated feet for improved grounding.
* EXCLUSIVE AT THIS PRICE LEVEL

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

Triplet

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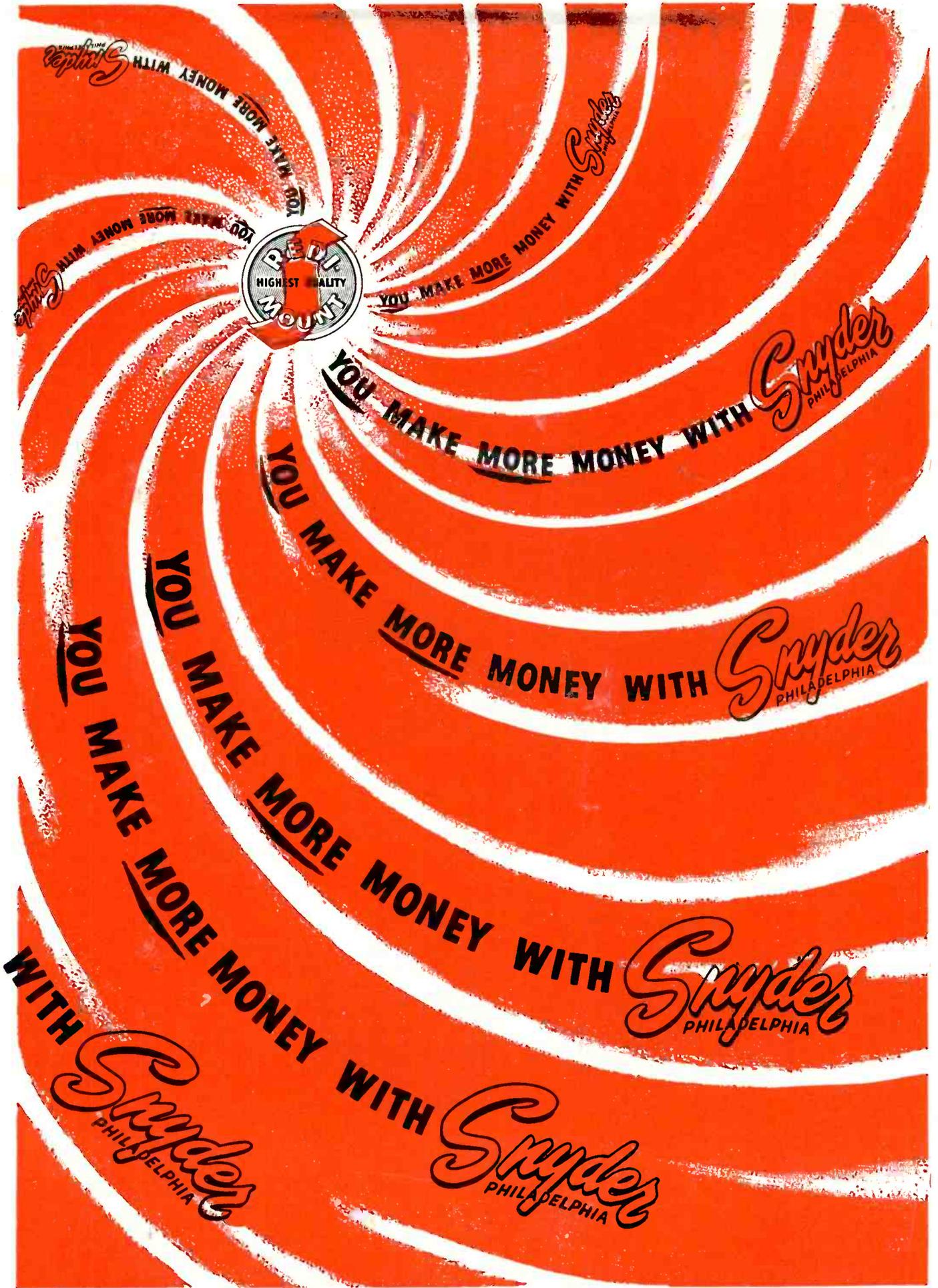


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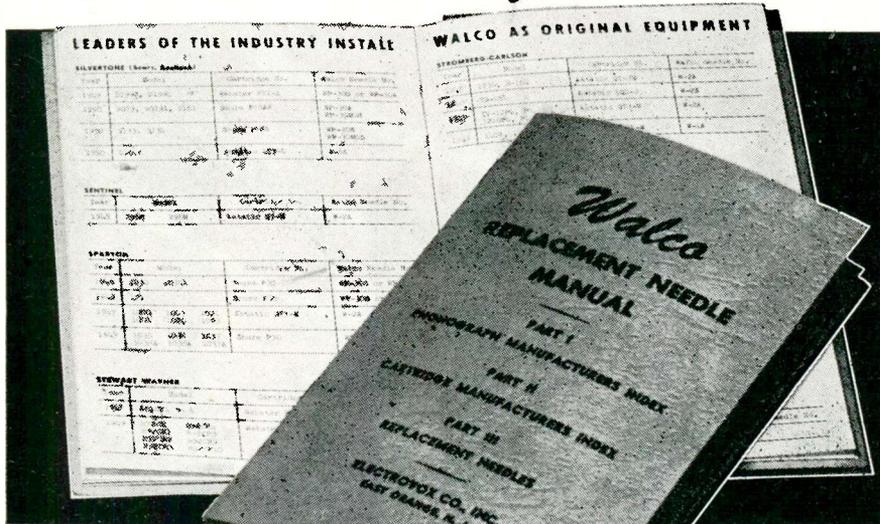
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TRADE FLASHES

[from page 8]

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This move is necessitated by the greatly expanded business of the company, which is manufacturing radio, television and industrial wires, besides a complete line of cords, cord sets and specialty products for the communications industry.

DuMont Keeps Faith With TV Set Owners

TV set owners can continue to bank on Du Mont Teletrons for their tube replacements through Du Mont distributors. Such is the basic policy laid down by I. G. Rosenberg, Manager of the Cathode-ray Tube Division of Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

In Mr. Rosenberg's own words: "Despite the initial equipment tube demand, now far outstripping even the tremendously expanded production facilities of our Allwood and other Du Mont tube plants, we are still taking care of the tube replacement trade through Du Mont distributors. A considerable percentage of our current output is being allocated to the replacement trade, while the major percentage of course goes to set manufacturers.

"The bulk of our current production is in 17" rectangulars and 19" rounds, with still larger tubes to come. Nevertheless, we will continue to supply 12", 12½" and 15" tubes to take care of the replacement needs of TV sets long in use. Du Mont realizes and respects a moral obligation to earlier TV set owners and does not intend to let them down even though the tube art has progressed to the larger tube sizes in current production. Teletron replacements can always be had through Du Mont distributors," concludes Mr. Rosenberg.

2nd Mallory TV Encyclopedia

The second edition of the Mallory Television Service Encyclopedia published by P.R. Mallory & Co., Inc., Indianapolis, Indiana, has just been released. This valuable reference manual contains servicing facts and figures needed by the professional serviceman for the repair of both TV and conventional radio equipment.

P. R. Shields Addresses Servicemen

TV servicemen like TV manufacturers must learn how to use test instruments properly if they are to get the best results in the least time,

[Continued on page 49]

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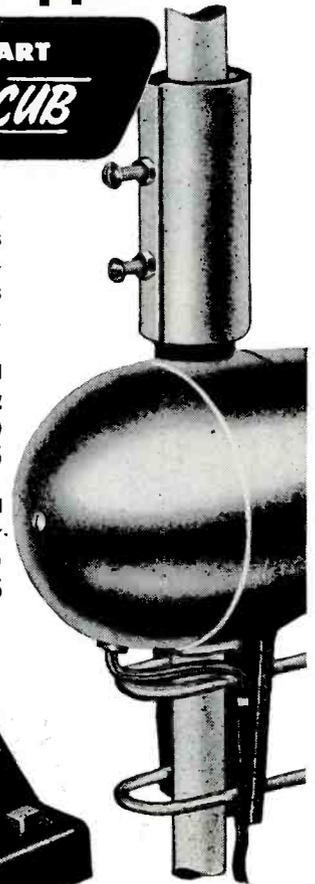
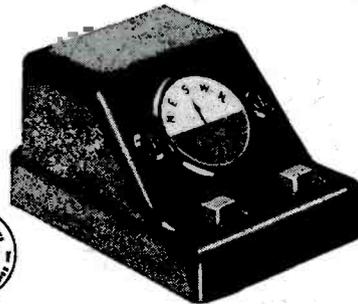
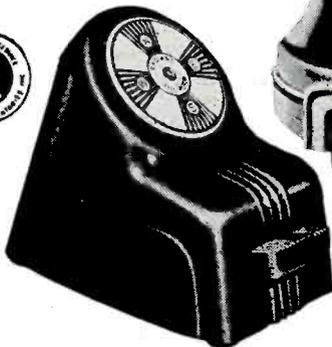
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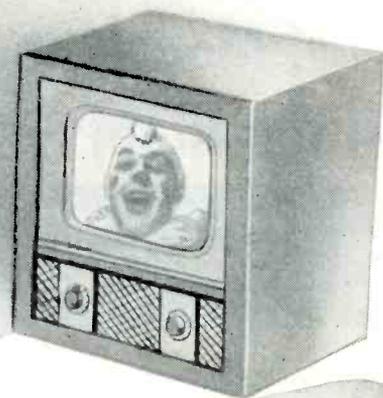
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101-JAB

TIME MULTIPLEX TRANSMISSION

by Edward M. Noll

(Author of, "Television for Radiomen")

This is the first of a series of articles by this author on color TV. Although the FCC has indicated its preference for a Field Sequential System, the author feels that a discussion of the various systems so far advanced is in order. In this installment he discusses the Sampling Technique which may be used in a Field Sequential System or any other system to improve horizontal resolution.

IN recent months, some of the merits of time multiplex system of transmission have been disclosed. With a premium on frequency assignments, these sampling techniques have shown great possibility. For monochrome, black and white television systems it can permit the transmission of a picture with a higher resolution than was thought possible with the present conservative six megacycle channel. This method of transmission is used by RCA in their dot interlaced color television system, permitting color sampling (of three basic colors) and transmission of a highly resolved color image.

So far as radio communication is concerned, the present sampling technique means a number of conversations or programs can be readily transmitted via a single r-f carrier. This information could be in the form of high frequencies, low frequencies, or even a d-c component depending on whether audio, video or any other special information is to be conveyed. Regardless of the frequency make-up of the individual signals to be transmitted, sampling technique takes better advantage of assigned frequencies. Advantages are multiple use of a single carrier, transmission of highly resolved information in a limited bandwidth, or a combination of both.

Certainly multiplex methods of transmission for these reasons should be given consideration by industry

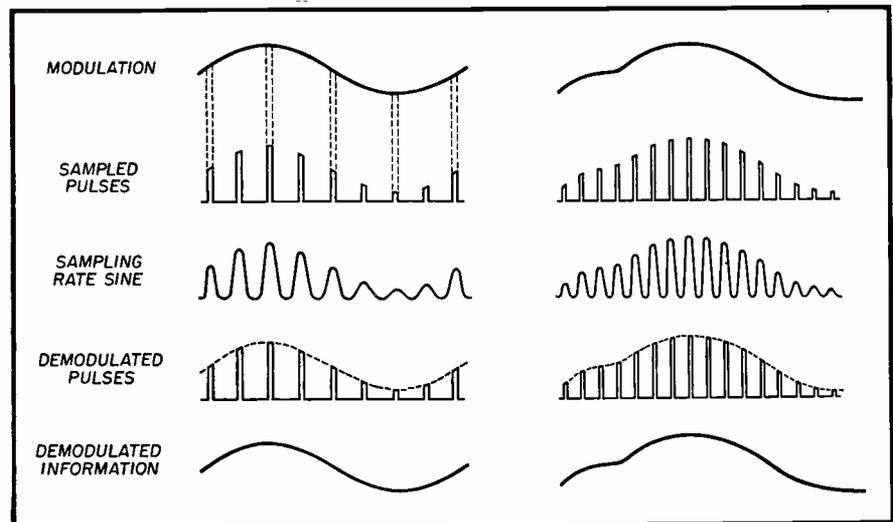


Fig. 1. Pulse Sampling Technique.

and government so far as use in the VHF and microwave frequency spectrum. It is perhaps too late to consider its adaptation in our present low frequency broadcast and VHF allocations. For example, it could permit three (or more with additional complexities) stations to use a single r-f carrier for transmission of their respective signals with a substantial reduction in necessary frequency spectrum. Although the frequency band needed by the single r-f carrier would be somewhat greater than ordinarily allocated it would still represent a substantial saving in spectrum as com-

pared to three separate channels and necessary guard bands. There would be a substantial saving in cost of high powered transmitting equipment because only r-f transmitter would be necessary. Likewise, a single radiating antenna and tower would be needed. Receiving antennas could be oriented toward it and receive peak performance from three stations. In the present state of development of sampling techniques process would involve a few additional stages. R-F tuner problems, however, would be reduced because of the fewer r-f carriers that need be picked up.

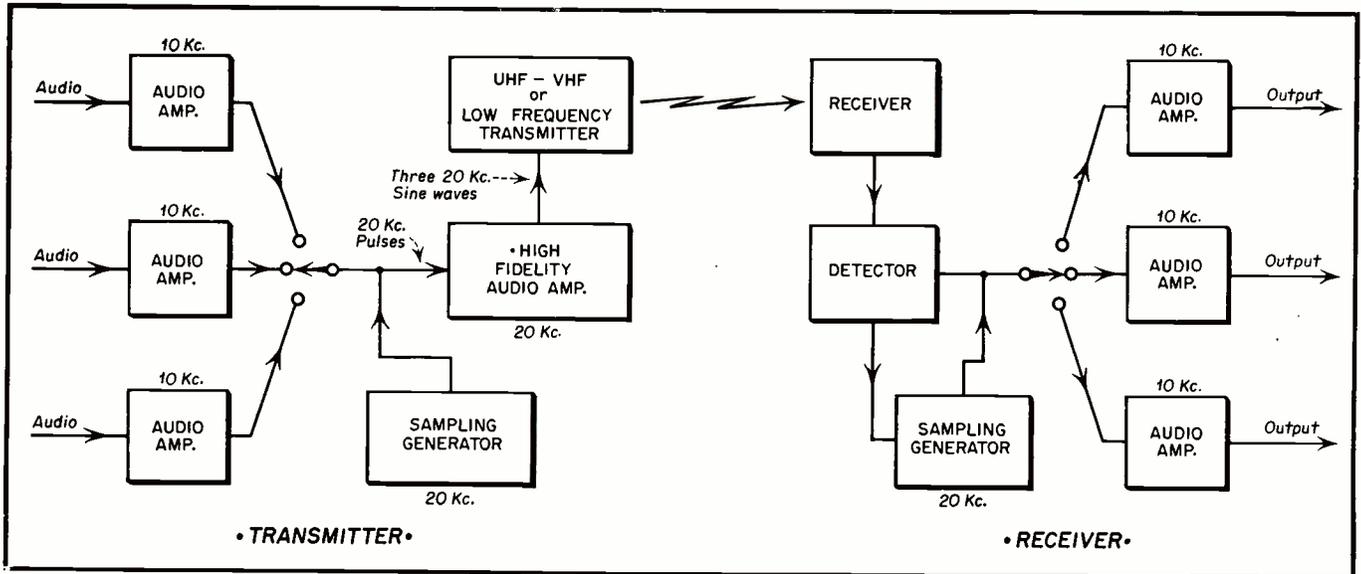


Fig. 2. Block diagram of Pulse Sampling Audio System.

Multiplex and Sampling Techniques

Multiplex and sampling techniques are not unduly complex and can be understood quite readily. The basic idea of sampling can be illustrated and explained very simple, *Fig. 1*. In the first example, a simple sine wave is to be conveyed. Various points along that sine wave are measured or sampled in terms of voltage amplitude. In fact, a train of pulses are generated, each pulse representing the amplitude of the sine wave at the point sampled. These pulses are then converted to sine waves of a frequency that is the same as the fundamental repetition or sampling rate. These sine waves modulate the r-f carrier of the transmitter.

At the receiver sine waves are demodulated from the r-f or i-f carrier. A sampling circuit at the receiver now takes these sine waves and converts them back into pulses. The spaces between pulses is now filtered in and the pulses dispensed with, forming a signal variation similar to the original. In a similar manner any random variation such as that shown in the second drawings of *Fig. 1* can be sampled and conveyed to the receiver.

A block diagram of a simple sound sampling system is shown in *Fig. 2*. In this system only a single signal is to be conveyed. Illustration and accompanying information describes operation with relation to only one signal to demonstrate the features and requirements of a sampling system. Later we will discuss the insertion of additional signals into the same system and how three separate signals can then be conveyed by the same basic carrier.

Let us assume that the signal to be conveyed is an audio signal with an

upper frequency limit of 10,000 cycles. Let us also assume at a given instant a pure 5,000 cycle sine wave is to be conveyed. This sine wave, as shown in *Fig. 3*, is sampled four times per cycle, each time producing a pulse indicative of the amplitude of the sine

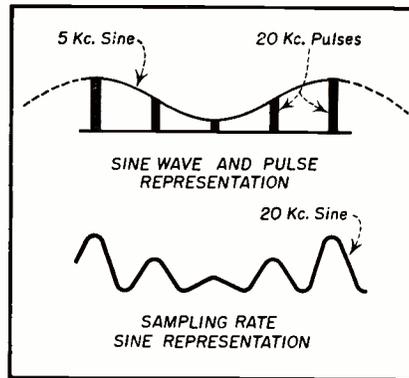


Fig. 3. Sampling of a sine wave.

wave at that instant. The rate at which the sine wave is sampled, of course, is 20 kc (5,000 cycles x 4).

These pulses are applied to the amplifier which has an upper frequency

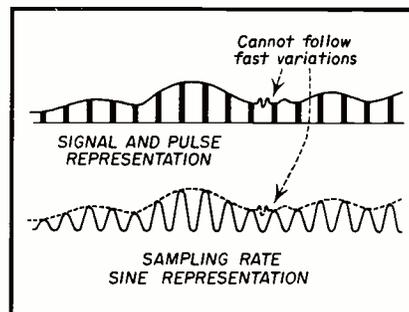


Fig. 4. Sampling of a Random Audio Signal. Inability to convey high frequency variations.

limit somewhat in excess of 20 kc. It is a fact that a pulse contains a fundamental frequency corresponding to its repetition rate and a substantial number of harmonics that are a function of the squareness and duration of the pulse. However, if these harmonics are removed beginning with the second one, the pulse can be reverted back to a fundamental sine wave. Thus if our pulse which has a fundamental repetition rate of 20 kc is applied to amplifiers which will only pass a band of frequencies somewhat in excess of this value, the harmonics will be removed leaving only a sine wave component (with a frequency the same as the repetition rate of the original pulse). In effect, the amplifier functions as a low pass filter and integrates the pulse.

Thus the pulse has been converted into a sine wave, the amplitude of which represents the amplitude of the original sine at the instant of sampling. The sampling device itself is a pulse which acts as an electronic switch and at prescribed intervals allows a portion of the original sine wave information to pass into the low pass amplifier. The switching rate of the sampling pulse is 20 kc. As the sampling process continues a stream of sampling rate sine waves are generated, amplitude of which varies with the changes in amplitude of the original signal. These variations are used to modulate the r-f carrier.

At the receiver the sampling rate sine waves are first demodulated from the r-f carrier and then are sampled at their crest by a sampling pulse at the receiver which is similar and is synchronized with the sampling pulse

[Continued on page 54]

Know the CATHODE RAY TUBE

Part 2

by ALLAN LYTEL

THE first anode is sometimes known as the focusing anode since by changing its potential the focus of the electron beam may be varied. It is also apparent that any change in the potential of the first anode voltage will not only affect focusing but will actually change both electrostatic lenses. When the brightness control which affects the control grid voltage is changed, this also changes the shape of the first lens hence changes the focus of the electron stream. In the electron guns previously described, a change in the relative potential between control grid and cathode changes the strength of the electrostatic lens, hence in effect, changes the entire electrostatic focusing system. In the same manner changing the first anode voltage by means of the focus control the brightness is also affected. Interaction between the focus and brightness controls of the electron gun is prevented in the improved type of electron gun through the use of an additional element as in Fig. 7.

An accelerating grid is placed between the control grid and first anode, but this accelerating grid or *grid number 2* is electrically attached to the second anode hence it has the same potential as the second anode. In this manner, the first electrostatic lens is formed between this *grid number 2* and the control grid; the second electrostatic lens is now formed between the first anode and second anode and there is no interaction between these two lenses. The first anode is now effectively isolated since it has *grid number 2* on one side and the second anode on the other side, both of the same potential. Changing the focus control which varies the first anode voltage now has very little effect on the brightness and controls only the focus action since it adjusts only the second lens. *Grid number 2* has the

In this second and concluding installment the author first explains the theory and operation of the electron gun and the fluorescent screen. Following this, an analysis of a commercial 'scope is made with particular emphasis being placed on the functions of the various controls.

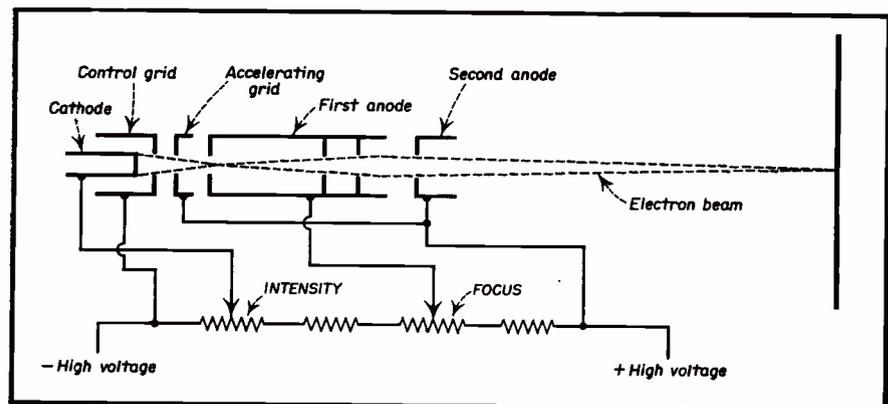


Fig. 7. Electron gun with an accelerating grid.

full high voltage applied to it, and it may be separated from the control grid by a greater distance than the first anode could be separated in the original electron gun.

Design improvement has resulted in the electron gun shown in Figure 8 which is the type of gun used in the DuMont 5BP1-A cathode ray tube. The original accelerating grid or *grid number 2* has been made longer and now contains several apertures: It is now generally known as the pre-accelerator. At the same time, the first anode has been made considerably shorter and is now used primarily with the second anode for Focusing. As seen from the drawing, the first electrode is the pre-accelerator which is the longest electrode in the series.

The next element is the focusing anode which we formerly knew as the first anode; the final element in the figure is now known as the accelerator anode which we formerly knew as the second anode. Again, the pre-accelerator and the accelerator are electrically tied together and operate at the same potential. Better focusing is accomplished with this improved type of electron gun and this is sometimes known as the zero-first-anode-current electron gun. The reason for this name is that there is now no current flow to the first anode or the focusing anode. Changes in the power supply voltage will now not affect the focusing arrangement and a change of the brightness control no longer affects focusing.

The DuMont type 5BP1-A has the

cathode operated at approximately -1500 volts in relation to the second anode. The second anode is operated at ground potential and the cathode has a high negative voltage of this value. The control grid is operated between -1500 and -1530 volts, the exact value depending upon the setting of the brightness or intensity control. Thus the control grid is at least as negative as the cathode and may be adjusted more negative. This will be apparent when we remember that the control grid must be sufficiently negative at some point of its setting to cause visual cut-off and prevent any electron flow.

The focusing electrode or first anode has approximately -1070 volts in relation to the accelerator anode or ground. The accelerating anode and the pre-accelerating anode are electrically connected together and both are grounded. In this manner, they represent the points of highest potential in the electron gun. Electrons are emitted from the cathode but electrons with sufficient energy are allowed to escape through the small aperture of the control grid; these are immediately accelerated by the very large difference in potential between the control grid and the pre-accelerator anode. They are focused by the action of the first anode or focusing electrode. In passing through the pre-accelerator apertures, the electron beam is confined to a very small size.

Between the grid and the pre-accelerating electrode, a great increase in electron velocity is obtained. This acceleration prevents the electrons from being attracted to the electrodes having the high potential. The most divergent electrons are removed by the apertures in these discs and the

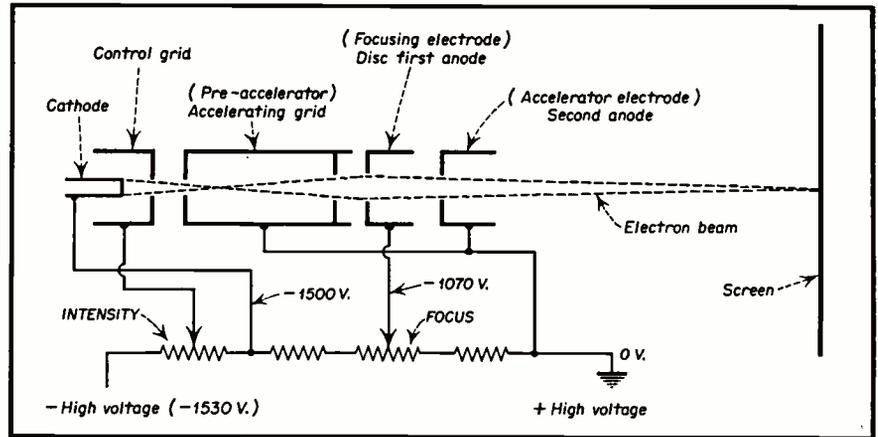


Fig. 8. Zero-first-anode-current type of electron gun.

electrons traveling in the center pass through the aperture and continue their forward motion. Between the



Fig. 10. The 5SP11—a multi gun CRT.

pre-accelerator and the focusing electrode, the electrostatic field reduces the velocity of electrons and causes them to diverge for the time they travel to the center point of the pre-accelerator. See Fig. 9.

As the electron stream again approaches the strong electrostatic field between the second anode and the final accelerating anode, their velocity is increased again. They are again converged and accelerated toward the fluorescent screen. Again the marginal electrons are removed by the aperture in the accelerator or second anode.

Electrostatic cathode ray tubes are also available in multi-gun units. Figure 10 is the 5SP11. An electrostatic cathode ray tube having two separate and individual electron guns. Each of these is capable of producing an entirely separate and independent signal on their common fluorescent screen. The cathode ray tube is used with the Model H21 dual channel oscilloscope manufactured by the

Electronic Tube Corporation. An example of its use would be the application of a deflection signal to 1 set of vertical deflection or signal plates and the presentation of marker signals on the other electron gun vertical deflection plates. In this manner, neither of the two signals could cause any possible interference. The markers would have no interaction with the applied test wave form. In the illustration, a ring of connections is shown about the neck of the cathode ray tube. Each of these connections is attached internally to a single deflection plate.

The Fluorescent Screen

The screen functions to make this motion visible on the tube face because energy of motion is transformed into visible energy. The inside of the tube face is coated with materials which will emit a fluorescent light when they are struck by high velocity electrons. Some of the materials used for this coating are zinc sulphide, calcium tungstate, and zinc orthosilicate. Various mixtures of these and other materials are used to provide the proper characteristics for the screen.

Among the characteristics which may be controlled, are the type of light, that is the color of the light produced, which is important in television applications. Another factor which may be controlled is the length of time when the fluorescent screen will retain an image after it is once produced. *Fluorescence* means that visible light will be produced only as long as the chemical material is excited by an electron beam. *Phosphorescence* means that light will continue to be given off by the screen for a period of time after the electron beam has been removed. The general term luminescence means the generation of light other than by means of heat. An ordinary light bulb, for example, is not luminescent since it provides light

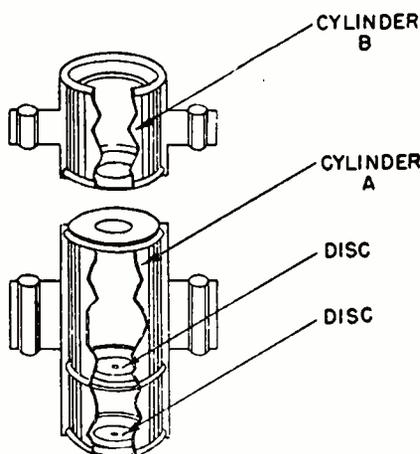


Fig. 9. Pre-accelerator electrode assembly.

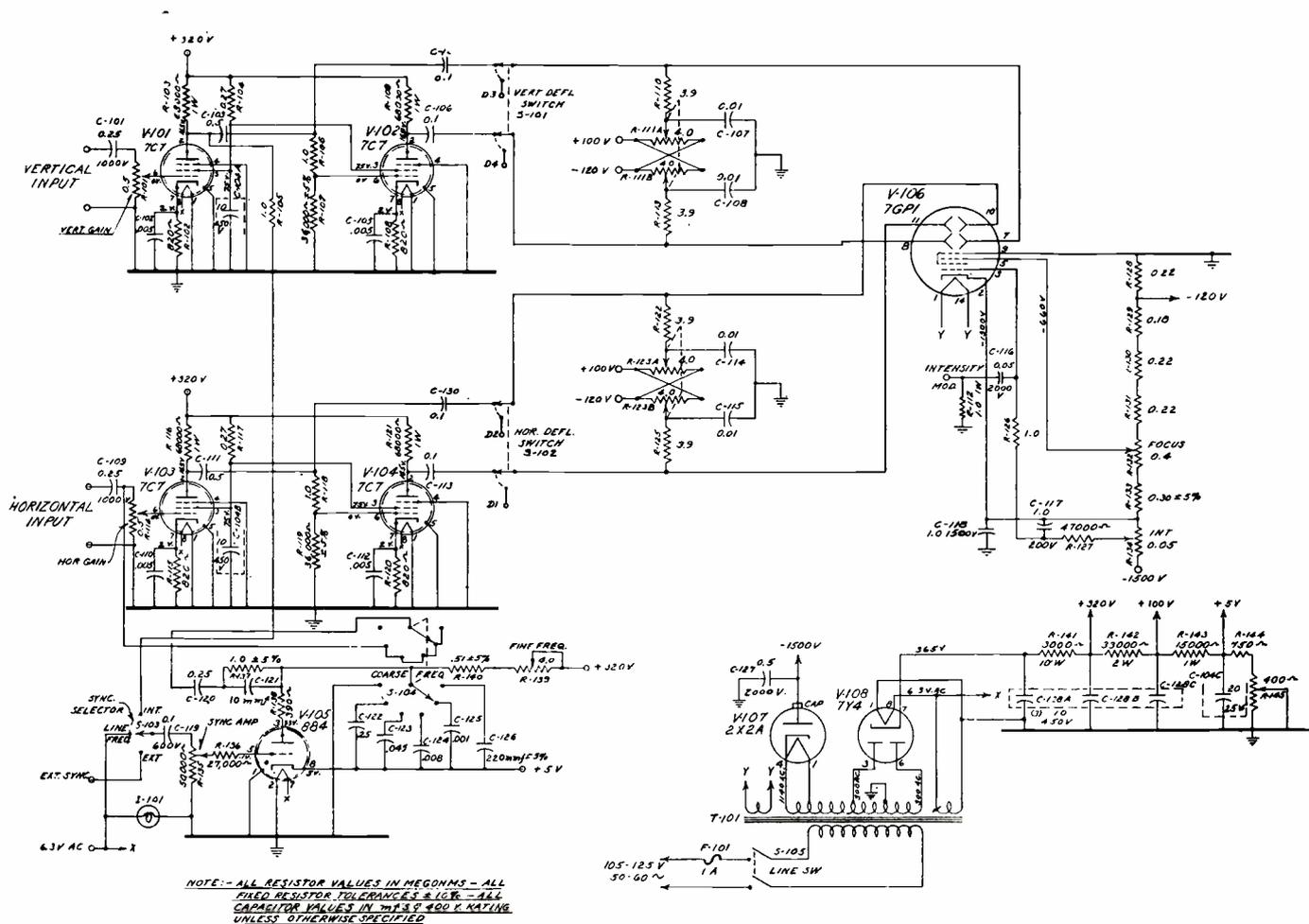


Fig. 11. Wiring diagram of Sylvania Model 132 CRO.

because of the heating effect of its filament. The cathode ray tube screen, on the other hand, is luminescent because light is produced by means of the electron stream.

Several factors affect light emitted by the screen: the number of electrons which strike the screen for a given unit of time may be varied and if the beam current is increased, more electrons reach the screen than if the beam current is decreased. An increase in the number of electrons reaching the screen will mean an increase in the number of light output. The longer a period of time the electron beam remains in the tube face, the greater will be the light intensity. If the electron beam scans slowly, a high intensity light output will be obtained. On the other hand, if the electron beam moves very rapidly, it will excite a given portion of the screen for only a short period of time, which will result in less visible light output. The velocity of electrons which strike the screen may also be controlled by changing the accelerating potential. High velocity electrons will, in general, give more light output than lower velocity electrons.

The fluorescent screen itself may be changed by various methods which will affect the light output. In television, for example, it has been found that a very thin coating of aluminum deposited on top of the fluorescent chemicals will increase the light output since electrons will penetrate the aluminum film, but light will not. This of course increases the available light on the tube face. Without such an aluminum coating, some of the visible light is lost since it goes back into the tube where it cannot be used.

Vacuum tubes have number and letter designations which tell something of their properties and uses. Cathode ray tubes also have standard Radio Manufacturers' Association classification which concern their uses and screen type characteristics. These characteristics involve the color and the persistency of the screen. These colors are usually green, blue, yellow and white. The screen designations are given by a capital letter *P* standing for persistency, followed by a numeral which has a special coded meaning.

The type P-1 screen has a green light output and a medium persistency. It is quite largely used for oscilloscopes since relatively bright screen

traces may be obtained with low voltage supplies. An increase in the accelerating potential increases the efficiency of the tube in converting electron beam energy into light. The type P-2 screen has a long persistent yellow after-trace or phosphorescence and an original blue-green trace. A screen of this type may have a pattern on its screen for several full minutes after the signal has been removed. The time duration depends upon the accelerating potential as well as the speed by which the electron beam is moved across the tube face. The time P-4 screen is quite commonly used for the television picture tube. It was designed for this specific application and produces an almost pure white light output. Its characteristics allow a persistence long enough to give the illusion of a complete picture on the television screen and at the same time, the picture disappears in time for the next one to be created by the electron beam.

Other special types of screens, the P-5 and P-11 are designed to be used when the cathode ray tube trace is to be photographed. In such applications, it is highly important that good definition is obtained in order that a sharp

image may be focused on the film of the camera.

Voltage Analysis of a C. R. T.

One of the current trends in cathode ray oscilloscopes is the use of a large diameter screen which allows a bigger visual pattern and is useful for alignment purposes. The Sylvania Electric Products Co. Oscilloscope type 132 is representative of this trend; it uses a 7GP1 cathode ray tube.

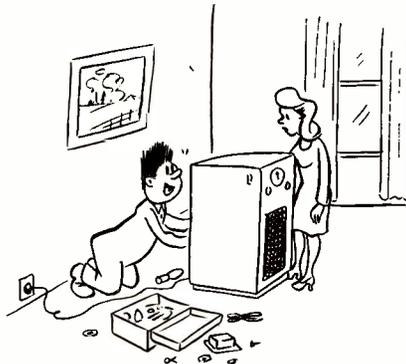
There are two general classifications of voltages which are necessary to apply to the cathode ray tube. A series necessary in order to produce, focus and accelerate the electron beam on its way to the fluorescent screen. Other d-c voltages are used to position the electron beam up and down and from side to side. The second classification of applied voltages may be called the various signals or alternating current potentials which are applied to move the electron beam across the tube face. These include the vertical signal, the horizontal signal or the sweep and the intensity modulation.

In Fig. 11 the type 132 oscilloscope is shown with its associated power supply and cathode ray tube. Each rectifier tube output has a series of resistors to ground which forms a bleeder network across the filter capacitors which supplies the individual d-c voltages.

In order to designate the tube electrodes properly, the individual pin connections on the tube face of the cathode ray tube will be used to name the individual electrode to which it is attached; for example the filament is connected to pins 1 and 14 and goes directly through connections marked Y-Y to the filament winding of the single power transformer. The winding is used for no other purpose and must be insulated for high voltage. The element nearest the heater is of course, the cathode connected to pin number 2. In succeeding order toward the fluorescent screen, the electrodes are the control grid (pin number 3) the focusing electrode (pin number 5) and the accelerating electrode (pin number 9) which is at ground potential. The vertical deflection plates connected to pins 7 and 8 are nearest the electron gun and the horizontal deflection plates which are connected to pins 10 and 11, are the last electrode set in the series.

A difference of potential is necessary to accelerate the electron beam and either the positive side of this high voltage may be at ground potential or the negative side may be grounded.

In either case, the value of the high voltage remains the same; however there are certain circuit simplifications which may be obtained by operating the accelerating electrode at ground potential and applying a high negative potential to the cathode. This is done in the 7GP1 used for this model 132 oscilloscope. The cathode is connected to a point of -1300 volts on the high voltage power supply bleeder in an arrangement of this *Intensity Control*, is between the cathode and the plate of the 2X2A diode. In order to obtain the necessary potential difference relative to the cathode, which is necessary for visual cut-off, the grid is operated at a more negative potential than the cathode. This element is connected by means of a series resistor to the center arm of the potentiometer R-134 which is the a voltage relative to ground between the limits of -1500 volts and -1300



"I'm not shocked! My hair is just unruly."

volts. Relative to the cathode, the control grid may be the same potential or it may be approximately 200 volts more negative than the cathode. This allows a sufficient potential difference so that the control grid may effectively prevent any electron flow to the screen and cause visual cut-off when this is desired.

By means of the *Focus Control* which is resistor R-132, the focusing electrode may have a variable potential in order to accomplish its focusing action. This average value is approximately -660 volts in normal operation and it may be varied depending upon the setting of the potentiometer.

The high voltage power supply and gun is on the accelerating electrode which in this case is ground potential. As shown in the schematic, an electron gun of this type has two sections for the accelerating electrode; one section is on either side of the focusing electrode. The over-all potential voltage within this range is avail-

able. The potential difference between the accelerating electrode and the cathode is -1300 volts with the cathode being negative and the accelerator electrode being positive. The power supply has an output of -1500 volts but 200 volts of this total amount is reserved or set aside for use with the control grid.

The high voltage power supply and bleeder in an arrangement of this type has a very low current drain hence small values of capacitance are sufficient. There are effectively 3 filter capacitors in the circuit, the first, C-127 is a 0.5 microfarad capacitor from the plate of the rectifier tube to ground. The voltage rating of this capacitor, it will be noted, is 2000 volts providing a safety factor since the output is only 1500 volts. The second filter capacitor is C-118 a 1.0 microfarad value with a rating of 1500 volts, between the cathode of the 7GP1 and ground. A final filter capacitor, C-117 of the same value but with a voltage rating of 200 volts is used between the control grid and cathode. Since the accelerating potential is 0 or the same as ground potential, the deflection plates without danger to age of approximately this value also in order to prevent defocusing. One of the advantages of operating the final electrode of the electron gun or ground potential is the low value of voltage which may be applied, so that direction connection may be made to the deflection plate must have a d-c voltage centering operator. The vertical deflection centering controls use a variable d-c voltage to move the electron beam up and down the tube. There are two high value potentiometers connected in parallel; these resistors are ganged on the same shaft. Across each of the potentiometers, there is a potential difference of 200 volts used for centering.

The vertical deflection plate connected to pin 7 is tied to the center arm of the variable potentiometer R-111A, through a series resistor. As this arm is moved to the left in the drawing, it reaches a voltage point of plus 100 volts.

As this center arm of the potentiometer is moved to the right, it reaches a value of -120 volts. In this manner, any voltage within this range is available at the center arm of the potentiometer which is a part of vertical centering control and connected to one vertical deflection plate.

The opposite vertical deflection plate is connected in a similar manner to R-111B which is part of the gang vertical centering control. A criss-cross of the wiring on this dual con-

[Continued on page 52]

FRONT ENDS

by SAMUEL L. MARSHALL

From a forthcoming book,
"Television Service Techniques."

Part 5

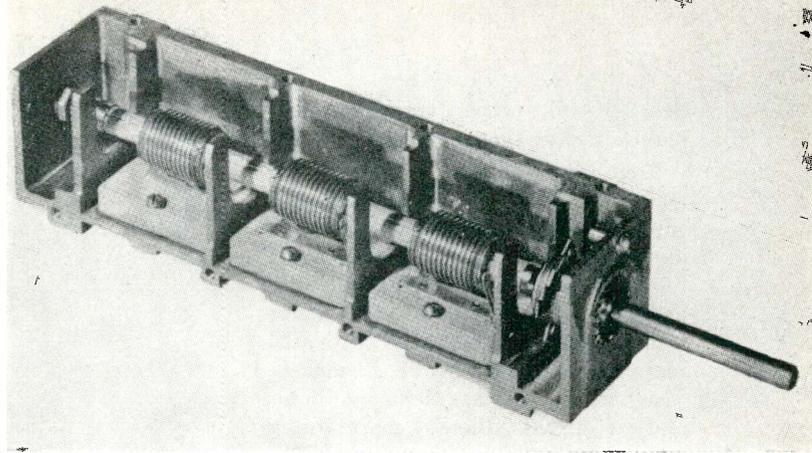


Fig. 3-38: Early mechanism of Mallory-Ware Inductuner.

This installment completes the discussion on the electrical and mechanical methods of band selection used in Front Ends of various manufacture. Variable inductance and capacitance system are described.

Continuous-Tuned Variable Inductance

A third method of band selection makes use of a circuit section in which continuous tuning from 54 to 216 mc is accomplished by rotating a coil against a set of contacts, thereby making available connection to any point on the coil. This tuner, shown in Fig. 3-38, is variously referred to as the Mallory-Ware Inductuner and the DuMont Inputuner.

Figure 3-39 is a simplified partial schematic of the 4-section Inputuner, Series T4A. It contains a single antenna section, a double r-f bandpass section, and an oscillator section. Earlier models of these units contained three sections; a double r-f bandpass section, and a single oscillator section. More recently an improved 3-section tuner has been made

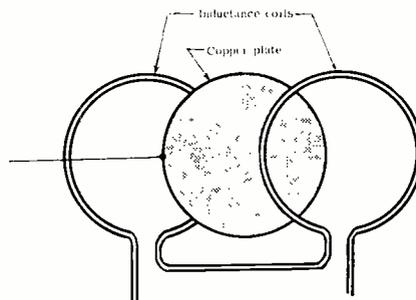


Fig. 3-40: Basic tuning principle of a copper plate in a coil.

available. Examination of Fig. 3-39 reveals that the inductors L_1 , L_2 , L_3 , and L_4 are the actual inductors that cover the required frequency range. L_{1a} , L_{2a} , L_{3a} , and L_{4a} are referred to as the "end inductors", and are primarily designed to effect more

efficient operation as the main tuning inductors are rotated toward their end points. Also, in association with the capacitors C_4 , C_{10} , C_{12} , and C_{18} , these end inductors effect proper tracking at the high and low frequencies.

Because of the nature of its electrical circuits and mechanical construction, permitting continuous tuning between 54 to 216 mc, this tuner is used to receive FM signals between 88 and 108 mc.

Another type of continuously tuned variable inductance front end makes use of the principle in which a fixed inductor and a movable non-magnetic plate such as brass or aluminum are arranged as shown in Fig. 3-40 to produce a variable inductance effect. This plate acts as a *shorted turn*, reducing the magnetic field and the net inductance of the coil.

A commercial product in which this principle is employed is shown in Fig. 3-41. This unit consists of a stator containing a number of stamped copper turns between which a number of copper plates are rotated in the same manner as in a variable condenser. The total inductance of the coil is a minimum when the rotor is fully meshed with the stator.

Three coils are used in each stage. These coils individually cover Channels 2 through 6, 7 through 13, and the FM band. As the tuning mechanism is rotated, a slide switch mounted on the rear of the shaft as shown in Fig. 3-41 automatically switches the tuner through the lower channels, the higher channels, and the FM band. During operation the FM coil is shunted across the Chan-

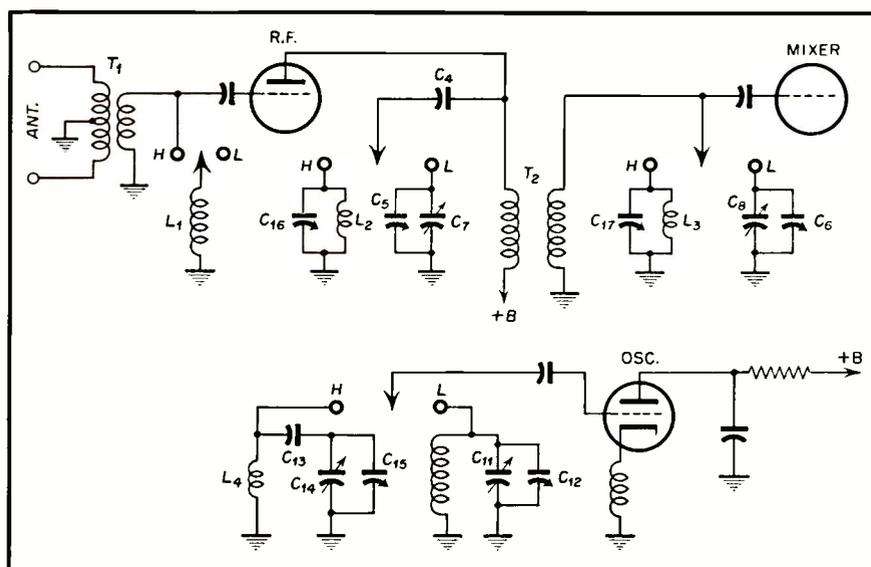


Fig. 3-39: Simplified schematic of 4-section tuner.

nel 2-6 coil, proper tracking being maintained by the circuit components.

This tuner is very flexible in its applications, being available for continuous tuning or for operation with an dedent mechanism allowing quick selection of any channel. It is also available with or without FM. A fine tuning control, concentric with the main shaft, is included on all models. This control adjusts both oscillator and r-f circuits, thereby maintaining excellent tracking throughout the complete frequency range between 54 to 216 mc.

Variable Condenser Tuning

A simplified Front End circuit using variable condenser tuning is shown in Fig. 3-42. Its commercial counterpart is shown in Fig. 3-43. The unit is a continuously tuned device with a gap between 88 and 174 mc. This gap is bridged by using a cam on the condenser shaft which controls a switching arrangement, throwing in the high frequency coils

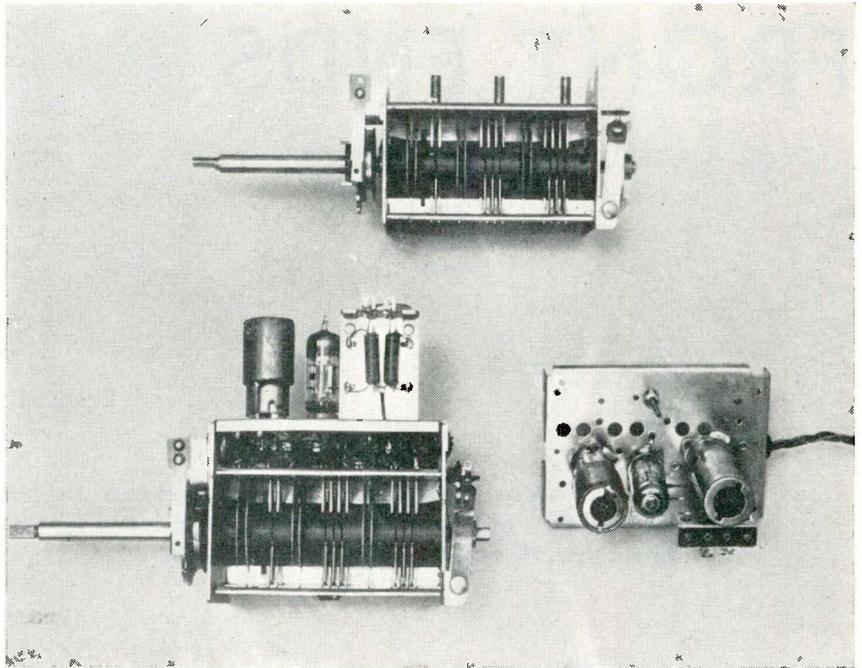


Fig. 3-41: The LYT-L-TUNER

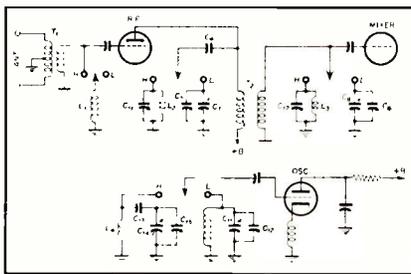


Fig. 3-42: Simplified variable condenser tuning circuit. L_1 , L_2 , L_3 , and L_4 are the high frequency coils.

and trimming condensers as the dial passes the 88 mc dial setting.

A 4-gang variable condenser is used in which C_7 is the r-f, C_8 the mixer, C_{11} the low frequency oscillator, and C_{14} the high frequency oscillator tuning condensers. When the dial pointer passes Channel 6 the cam switch effectively shunts the h-f coils across the r-f and mixer coils, and substitutes C_{14} for C_{11} in the oscillator tank circuit.

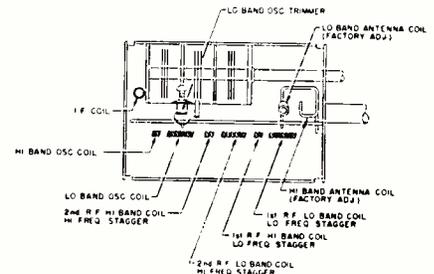


Fig. 3-44: Electuner details.

The various trimmers indicated by C_{16} , C_5 , C_{17} , C_{15} , and C_{12} are used to align the tuner at the low and high frequency channels. C_{13} is a negative temperature coefficient compensating condenser.

Another tuner, also using variable condensers, and previously analyzed in the stagger-tuned category of Front Ends, is the General Instrument Corp. Model 44 Electuner. Figure 3-44 illustrates diagrammatically the internal placement of the coils and the variable condensers.

Continuous tuning of Channels 2 to 6 and 7 to 13 is provided in two coil ranges by means of a 2-position switch which is actuated by a knob concentric with the fine tuning shaft. This switch also selects the high or low band antenna sections which are separate and consists of two band-pass circuits. A certain amount of overlap above and below the lowest tunable channel in each range is pro-

[Continued on page 52]

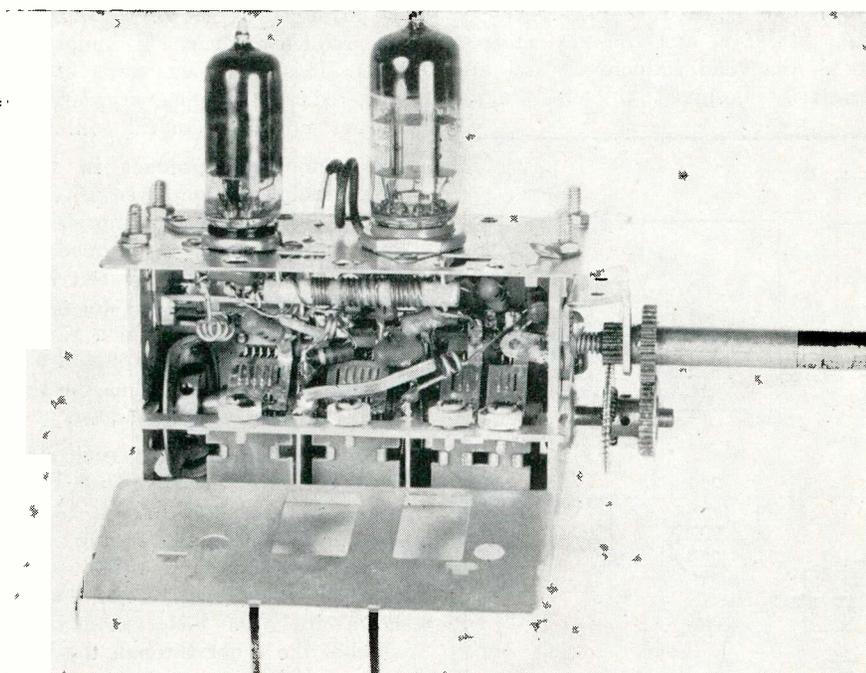


Fig. 3-43: Radio Condenser Co. Model TV 12 Front End.

Electrical Requirements Of TAPE RECORDERS

by C. A. TUTHILL

Thus far in this series, of which this is the final installment, we have covered theory and the mechanical features of tape recorders. For a better acquaintance with the electrical requirements of tape recorders we need merely draw upon previous experience with r-f and audio oscillators and amplifiers and then add a dash of common sense. Most of the basic electrical features which apply strictly to magnetic tape recording are not all foreign to servicemen.

MUCH less power is required in tape than for competitive methods of recording,—a selling point in itself. At 1000 cycles one milliwatt of power, from one triode section of a 6SN7, will adequately drive most tape recording heads. Amplifier cost is minimized. The total power required for tape machine operation under full motor and amplifier load ranges from 60 watts for the smaller machines, to hundreds of watts for the glorified rigs. The source should be a 60 cycle 115 volt supply so as to permit synchronization of home movies with sound record on tape. A fruitful market is opening up in that field of application. Vacation pictures can be scored with facts, figures and frolic for future enjoyment.

It is unfair to make direct comparisons between various equipments due to dissimilarity of results possible from them, nevertheless, it is necessary to list a few examples in order to disseminate facts about power. For example, the Pentron combine of superhet radio and tape recorder pulls a total load of 100 watts. The Magnecorder draws 70 watts and requires 60 more watts of power for its amplifier, but, that amplifier includes a three position mixer which introduces loss in return for added facility.

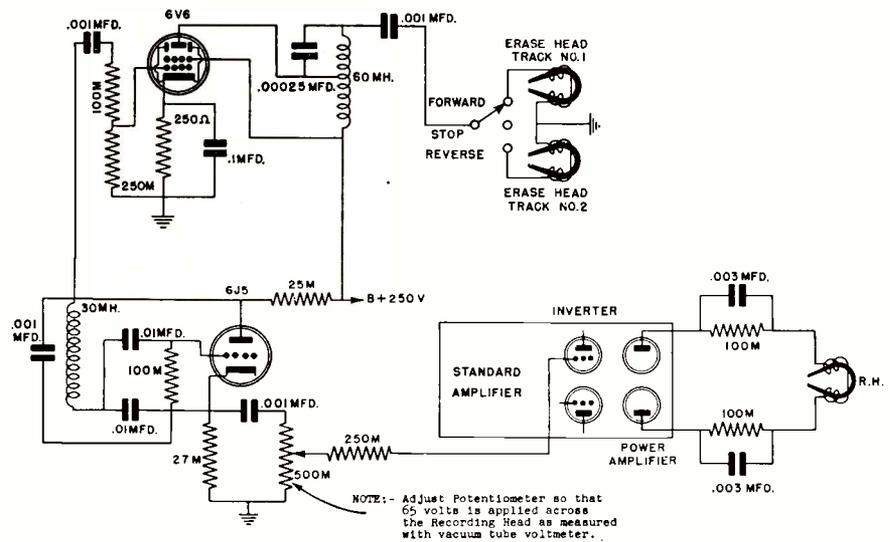


Fig. 1. Supersonic bias oscillator and output coupling circuit required to utilize amplifier for recording.

Several manufacturers use a separate amplifier for reproduction for reasons stated under the section "Playback." The higher priced Ampex employs three motors. They use one dual speed synchronous motor for capstan drive and two others on reel assemblies; one expressly for rewind.

Recording Amplifiers

No recording will be any better than the restrictions imposed upon it by the recording and/or playback amplifiers. Equalization may best be

built into an amplifier unit to retard tampering. However, when equalization is applied externally, the amplifier used should be capable of linear reproduction of the entire FM spectrum (50 to 15,000 cps). The more expensive machines do better than that for reasons of competition from other methods of recording or for discreet customer satisfaction.

Amplification of the h-f bias oscillator signal is usually built into the audio amplifier chassis as discussed

Construction and Operation of a CABLE SPINNER

by ALFRED R. CZARNECKI

RECENTLY we were faced with the problem of installing a Program Line between a Remote Point and a Centralized Radio Control Rack which were separated by about 3000 feet. Part of the line was fastened to the side of buildings, while other portions of the line was run overhead between poles. The average height above the ground being about 25 feet.

The long overhead runs made it necessary to use a rust-proof Messenger Wire to support the Program Line. It was decided that the simplest way of binding the Program Line to the Messenger wire would be to spin a spiral winding of weather-proofed Hemp Cord around both. This was done by securing the Messenger, Program Line, and Hemp Cord to the insulator at the top of a pole, leaving the other end of all three on the ground. One man held the Messenger and Program Line together, while another man passed a ball of Hemp Cord under and over until the cord was spiraled over the Messenger and Program Line to a distance that would include a few feet beyond the next pole. At this point the completed cable



Fig. 1. Showing the unspun hemp cord.

This article describes a unique device for respinning a messenger cable with a program line without removing or dropping the messenger wire or program line to the ground. This device does the job in the air, the operators remaining on the ground.

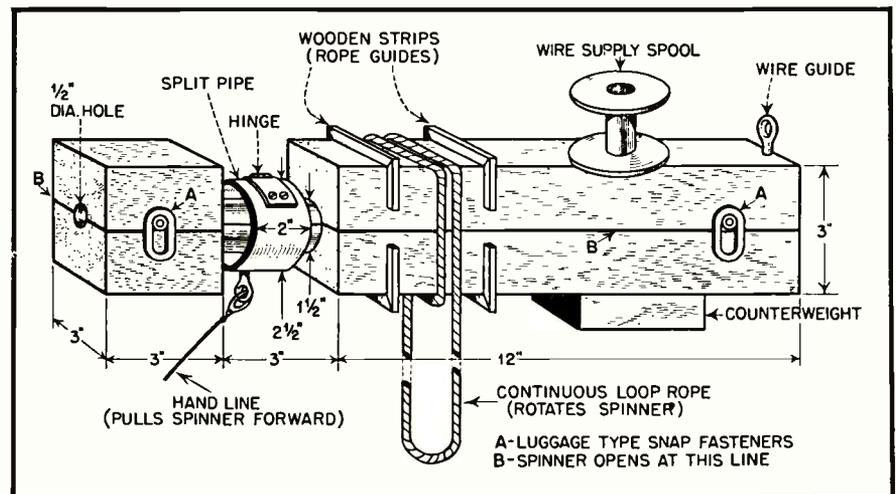


Fig. 2. Construction plan for the cable spinner.

was hauled to the top of the pole and fastened as at the first pole, after which the process was repeated until the entire overhead run was completed.

After about a year it was found that "our fine feathered friends" discovered that the Hemp Cord made excellent material with which to build nests for themselves. It wasn't long before the Cable took on the appearance of Spanish Moss. (Fig. 1) Needless to say, the situation had to be rectified almost immediately.

The problem was to remove the old Hemp Cord and respin the Cable with some material which would be less useful to the sparrows and crows. The respinning had to be done without dropping the Messenger and Program

Line to the ground, as this would have required cutting the Program Line at each pole. It was decided that splicing the Program Line would have injected too many possibilities of failure in the future.

Some sort of device had to be obtained to do the job in the air. Nothing was available that would fit our needs, so we set to work building a device that would serve the purpose. Inasmuch as the Messenger Wire was not heavy enough to carry a man, any machine devised would have to be operated from the ground.

After considerable paper work, the finished device appeared as in Fig. 2. It was made from a block of Oak

[Continued on page 48]

LIGHTNING A TV ANTENNA

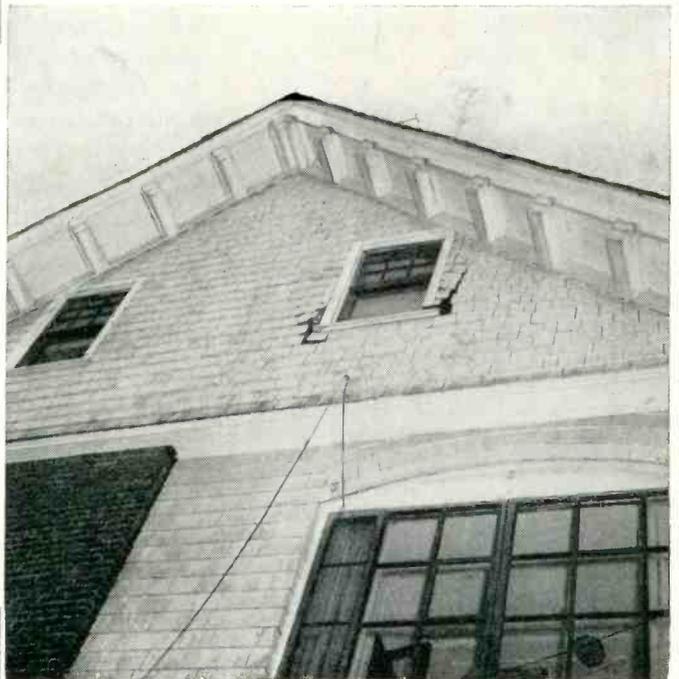
This is a picture story of what happened with lightning on a house top in Brooklyn, New York. For the receiver was not turned on, so that no damage was done to the receiver. The installation did not contain a lightning arrester, and the damage shown below. Where lightning is worth a pound of flesh.



Fig. 1 (top). This is the TV antenna that was struck by lightning. Notice the absence of the downlead which was ripped off by the stroke.

Fig. 2 (right). This is the damage done to the side of the house along which the downlead ran. The downlead was fastened along the frame of the top window. Damage around this area was considerable. Notice how the window frame was splintered and the shingles literally blown off the side of the house. One of the shingles landed 60 feet away. The downlead itself was pitted together with the stranded copper conductor as a result of the tremendous heat in the wire.

Fig. 3 (below). Interior view of the top window showing the extent of damage done at this point. The violence of the shock splintered the inside framework, broke the window pane, and shattered the plaster on the wall.

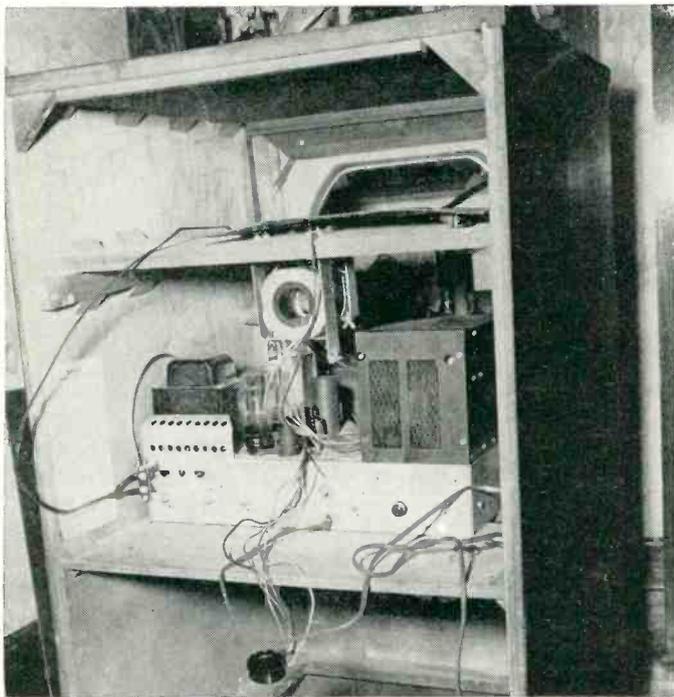


THE Board of Fire Underwriters recommends that a TV antenna installation be properly connected to an *effectively grounded* lightning system. If the antenna itself is not grounded, an approved lightning arrester must be inserted in *each* conductor of a downlead. Thus, if twinlead is used, two lightning arrestors, or a double lightning arrester must be used. If the antenna is mounted on a mast which is effectively grounded, or if the downlead is protected by a grounded metallic shield as is the case with coaxial cable, no lightning arrester is required. Where possible however, all metal masts should be effectively grounded.

It is emphasized by the Fire Underwriters that lightning arrestors should be located either outside the building, or if inside the building at the point of entrance of the downlead into the house. *Arrestors should not be located near combustible material.* The simplest and most effective lightning protection for TV installation is obtained if the lightning arrester is mounted on the metal mast of the

LIGHTNING STRIKES TV ANTENNA

When lightning struck a TV antenna mounted unfortunately, the owners were not at home and no one was hurt. But significant is the fact concerning an arrester which could have prevented the concern, "An ounce of prevention is surely of cure". S. L. M.



antenna, and the ground connection from the arrester is made directly to the mast. Of course, the mast must be effectively grounded. If more lightning protection is desired, two lightning arrestors may be used, one at the point of entrance of the downlead into the house, and the other on the mast.

One of the requirements of an effective ground is that the ground clamp be a bolted clamp of cast bronze, brass, or cast iron. Ground connections to a pipe may also be made using suitable pipe fittings or plugs screwed into the pipe. Connections to grounds made by soldering the ground wire to a ground are *not* acceptable. However, where the ground wire is soldered into a ground lug and the lug is properly fastened to a ground clamp the installation is approved. Ground lugs in which the ground wire is inserted and then clamped on by pressure are also approved. Ground clamps of the sheet metal type are not generally approved."

*From "Television Installation Techniques,"
by Samuel L. Marshall (John F. Rider Publisher.)*

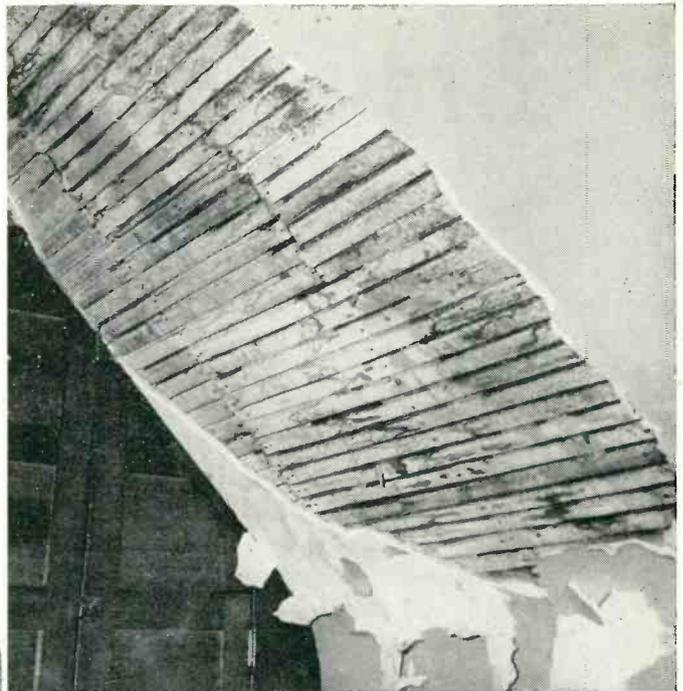
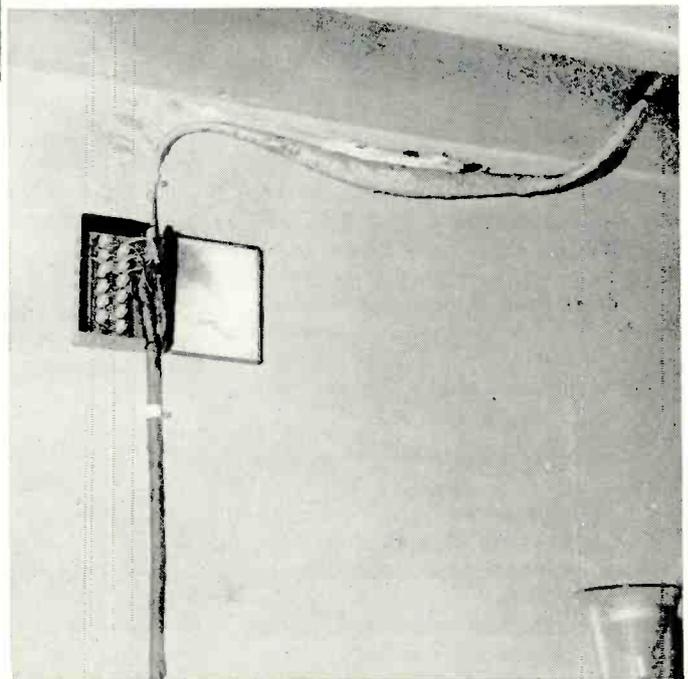


Fig. 4 (top). The shock was so violent that the ceiling plaster in an adjacent room was damaged over a wide area.

Fig. 5 (left). Oddly enough, the only damage to the receiver was sustained by the picture tube. Following the stroke the electron beam in the tube could not be centered. The above illustration shows a rear view of the receiver with the damaged tube removed. In the same room however, a lightning fixture was thrown clear off its housing.

Fig. 6 (below). Tracing the path of the lightning stroke we observe in this photograph that it proceeded down into the telephone cable box located in the cellar. Notice how the intense heat seared and blistered the wall and ceiling. The stroke finally ended in ground cable of the telephone system located in the garden outside.



SHOP OVERHEAD ANALYSIS

by **FRANK H. RUSSELL**

Sales Promotion Manager, Philco Corporation

The subject of shop overhead analysis is one which, if given proper attention by all Radio-TV Service Dealers and contractors, can do much to prevent premature greying of the hair for these individuals. In this article, which was presented by the author recently in the form of a talk before a group of technicians, a critical analysis is made of the business operations of a successful TV service contractor. Facts and figures are given.

THE first step in analyzing shop overhead is to determine just where the money is going before it is spent, rather than where it has gone after it is spent. It sounds easy, but without a proper bookkeeping system it is difficult to sit down and attempt to remember each item dealing with business expenses and profits at the end of the month. If the service operation is sufficiently large to afford it, the services of a bookkeeper and a certified public accountant to check the books periodically, will prove invaluable.

In the case of the smaller operator, however, a system of accounting may merely consist of a simple notebook or ledger in which items of expense and income can be entered daily. It isn't necessary to place all items in a certain place in the book other than as debits and credits, or the "I paid column" or "I received column." Then at the end of the month all credit and debit items can be placed in their rightful places in another book or sheet of paper which includes the following items, and is known as a Statement of Income.

Statement of Income

Under Income should be listed:

1. Installations — which include antenna erection charges.
2. Service Contracts — amount received for one year policies.
3. Second year contracts—amount received for second year policies.
4. Other Service — amount re-



Frank H. Russell

ceived for service not covered by contract.

5. Sales of Parts and Tubes—
6. Less cost of Parts and Tubes—

These items can be totalled and called Net Sales.

Next should be listed: Installation and Service Costs— Included are:

1. Wages—Service men
2. Depreciation—Truck and shop equipment.
3. Shop supplies.
4. Car allowance—Service men.
5. Auto and Truck expenses.
6. Truck rental.
7. Garage rental.

These items can be added and indicated as total installation and service costs. Total installation and service costs can then be subtracted from

Net Sales to arrive at Gross Profit on Service.

That, of course, is not all. There are many items of expense and these should be known as "Other Expenses" such as:

1. Wages—Other than servicemen, and always include yourself under this heading. It is important to pay yourself a reasonable fixed monthly salary and to include it as an expense item. So many business owners forget this and draw on business profits for their own personal needs. This practice may well lead to bankruptcy as too many persons draw heavily on their business in good months with little regard for the possible dark days ahead when monthly profit may be less than expenses.

2. The second item is Depreciation of Office Equipment. The amount chosen for depreciation should be kept in a separate account to be used when new equipment must be purchased. All things in time will wear out and it is well to have the cash on hand to apply toward replacement items.

3. Office Expense—such as paper, printed matter, bill heads, business cards, shop repair tags, letterheads, envelopes and general supplies.

4. Rent

5. Heat

6. Light

7. Postage

8. Telephone

9. Advertising — This item must

A PHILCO TELEVISION SERVICE MEMBER STATEMENT OF CONDITION MAY 31, 1950		EXHIBIT A	A PHILCO TELEVISION SERVICE MEMBER STATEMENT OF INCOME FIVE MONTHS ENDED MAY 31, 1950		EXHIBIT B
ASSETS			INCOME		
<u>Current Assets</u>			<u>MONTH OF MAY</u>		
Cash	_____		Installations (Net of Antenna Costs)	_____	
Accts. Receivable	_____		Warranty Service Contracts	_____	
Inventory Parts and Tubes	_____		Second Year Warranty Income	_____	
Total Current Assets	_____		Other Service	_____	
<u>Fixed Assets</u>			Repair of Factory Sets	_____	
Truck	_____		Model 2500 Modifications	_____	
Office & Shop Equipment	_____		Sales Parts & Tubes	_____	
Less: Reserve for Depn.	_____		Less Cost of Parts & Tubes	_____	
Total Fixed Assets	_____		NET SALES	_____	
<u>Other Assets</u>			INSTALLATION & SERVICE COSTS		
Prepaid Insurance	_____		Wages - Service Men	_____	
TOTAL ASSETS	_____		Depn. Truck & Shop Equipment	_____	
LIABILITIES			Shop Supplies	_____	
Loans Payable	_____		Car Allowance - Service Men	_____	
Accounts Payable	_____		Auto & Truck Expenses	_____	
Payroll Taxes	_____		Truck Rental	_____	
Accrued Wages	_____		Garage Rental	_____	
Advance Payments on Second Year Warranty Contracts	_____		Cost of Work Subcontracted	_____	
Deferred Dealers Warranty Plans	_____		TOTAL INSTALLATION & SERVICE COSTS	_____	
TOTAL LIABILITIES	_____		GROSS PROFIT ON SERVICE	_____	
<u>CAPITAL & SURPLUS</u>			OTHER EXPENSES		
Capital Stock Authorized	_____		Wages - Other	_____	
TOTAL CAPITAL & SURPLUS	_____		Depn. Office	_____	
TOTAL LIABILITIES, CAPITAL & SURPLUS	_____		Office Expense	_____	
			Rent	_____	
			Heat	_____	
			Light	_____	
			Postage	_____	
			Telephone	_____	
			Advertising	_____	
			Insurance	_____	
			Dues & Subscriptions	_____	
			Taxes Payroll	_____	
			Permits & Fees	_____	
			Leasehold Improvements	_____	
			TOTAL OTHER EXPENSES	_____	
			PROFIT ON OPERATIONS	_____	
			OTHER INCOME	_____	
			Discounts	_____	
			NET PROFIT TO SURPLUS	_____	

Typical forms that may be used to prepare statements of Condition and Income for given periods of time.

not be overlooked. A business may stand on its reputation, but advertising will make it grow. Such things as chassis stickers, signs, newspaper ads, radio spot announcements, handbills and direct mail campaigns will do much to keep your trucks equipment and men occupied during slack periods. A very popular and lucrative side line for the TV contractor is growing to be a big business. It is the conversion of receivers formerly having small picture tubes to larger size tubes. It pays to advertise this item, also.

10. Insurance—Always a good item to have in any business. Good protection for unforeseen catastrophes.

11. Dues and Subscriptions — It is well for anyone engaged in business to belong to trade associations to keep abreast of these changing times, as well as subscribing to trade magazines which can be very helpful.

12. Taxes—Payroll— Be certain not to overlook city and federal taxes.

13. Permits and fees—

14. Leasehold Improvements — This item would include repairs to the building and any improvements to the premises. These items should be totalled as "Other Expense" and

subtracted from the "Gross Profit on Service". The remainder will then be known as Net Profit on operations. This is done once a month to show what your business has accomplished during that month. These figures should be totalled with previous figures of the past months collectively to give you a clear picture of your progress over the year to date. All of this is known as a Statement of Income.

Statement of Condition

There is another statement which should be kept up to date which is known as the "Statement of Condition of your Company". This statement will list your assets and liabilities.

Under assets there are current assets and fixed assets. Current assets consist of:

1. Cash on hand.
 2. Accounts receivable.
 3. Inventory—Parts and Tubes.
- Added, they form total current assets.

Fixed Assets consist of:

1. Truck value.
 2. Office and shop equipment.
- Less reserve for depreciation this total becomes total fixed assets.

Another asset might be Prepaid Insurance. So, the total assets will

be found by adding total current assets, total fixed assets and other assets.

Now, under liabilities you may list:

1. Loans payable.
2. Accounts payable.
3. Accrued wages.
4. Advanced payments on second year contracts.

5. Advanced payments on first year contracts. Added, they become your total liabilities. Liabilities are then subtracted from the assets. The difference becoming the capital or net business worth. This capital can be used for business expansion.

Practical Illustration

In an attempt to understand the problems dealing with Shop Overhead and good business practices, I enlisted the aid of an established television contractor in one of the larger eastern cities. In this story of his new business venture he will remain anonymous and I shall call him "Mr. X."

Here is the story of a typical Television Service Agency that is just celebrating the completion of the first year-and-a-half in business. "Mr. X", the owner, threw up his hands at the mere thought of giving us completely all the details of his first year-and-

a-half. After he was assured that his "secrets" would be revealed only in the interest of guiding others who need this information he opened his records and his books and said simply, "I am in the television service business".

After the first year-and-a-half's operation the personnel breakdown is as follows, but "Mr. X" reminds us quickly that at the start he had only those indicated:

TODAY

Manager-owner, "Mr. X."
 2 office girls
 5 shop technicians
 4 outside servicemen
 6 installation men
 18 TOTAL

START

Manager-owner, "Mr. X."
 1 office girl
 2 shop technicians
 2 outside servicemen
 2 installation men
 8 TOTAL

Help was added only as the business warranted. Space was more than adequate at the start, but today "Mr. X" feels that he could use more than the 40 ft. x 30 ft. shop and storage space. He feels he needs larger quarters for safely protecting customer's receivers and stocking the larger inventory of parts he now carries. Office space, on the other hand, 15x15 ft. is still plenty large. As a matter of fact a small portion of this now is partitioned off to hold small tubes and costly components.

When asked if "Mr. X" had considered moving to larger quarters his answer made sense. "If I were to move it would have to be the same neighborhood because I get most of my business on this side of town within a radius of 15 miles in every direction. Moving headquarters in the service business, unlike sales, need not be fatal and I wouldn't hesitate if, first, I wouldn't expand here and if, second, I were to get the bulk of my business from another area.

"Mr. X" has good drive-in and loading facilities and is building quite a good reputation with dealers and what he calls C. O. D. accounts. He does not boast a thrilling success story, but keeps telling us he likes the work; is there every day; manages the entire operation and is "making a living." "Mr. X" had many years of experience in operating his own radio business, but admits making many mistakes in his first television days.

One of the girls acts in the capacity of office manager. She supervises the office work, handles the billing and the banking, and is constantly alert in controlling both the quality and the quantity of work done by her assistant. Both girls have been trained in good telephone habits. Both are very efficient in securing the necessary information from the customers who call in. Both are thoroughly trained to know just what to say. Of the five shop technicians, one is the chief trouble-shooter and acts also in the capacity of shop foreman. He makes out all estimates on shop service repairs, secures the necessary parts for the stock room and assigns and controls the work of the other four technicians. He checks out all parts used by the outside servicemen. He controls the inventory and makes out the merchandise requests which



"Shouldn't a leaky condenser make the radio wet?"

are then turned over to "Mr. X", who follows through on the ordering.

Proper Routing Of Men Very Important

The routing of service calls to the outside servicemen is done only by "Mr. X" because he feels this is a most important function. All outside men call in twice a day at certain specified times so that "emergency" calls can be handled with dispatch. "Mr. X" finds that the few minutes it takes to call in will save hours and money because he knows always just where his men are.

Trip Sheet

Late in the afternoon the dispatcher routes the next day's service calls on the Trip Sheet numbering them in rotation and fills in date, work order, number, customer's name and address. Trip Sheet is then placed in servicemen's bin with the work orders.

In the morning the serviceman picks up his work orders and the parts he needs for the day and signs the Trip Sheet at the top right which is then left with the dispatcher.

At 11 o'clock the serviceman calls the dispatcher who indicates on the Trip Sheet the progress of the calls. Where parts are needed to complete certain calls the item is listed in the remarks column. Later all parts are prepared and placed in the proper bin. The call is listed on the next day's Trip Sheet. The same procedure is followed when the man calls at 3.

A customer may call in saying she won't be home after 3. Another may have what she calls an emergency. In all cases it is quite easy to get this information to the proper servicemen because he calls in at 11, 3 and 5. It is easy to tell within a half-hour just where each man will be by simply checking the calls on the Trip Sheet.

After the 5 P. M. call the dispatcher signs the completed Trip Sheet and transfers what information is necessary onto the next day's schedule.

No commitments for extra work are ever permitted on part of outside servicemen without an OK from the office or the dispatcher. On P.M. calls for customers who are not at home during the daytime, men rotate weekly and work from 12 noon to 9 P. M. These P.M. servicemen also handle emergency calls and receive phone calls which come in up to 9 P. M.

The order in which calls are dispatched are:

1. Dead sets
2. C.O.D. calls
3. Contract calls (minor adjustments such as poor sound on one channel, bad record changer or radio in combination sets.)

Sources Of Business

In answer to the question where do you get your business, "Mr. X" lists these seven sources:

1. *Non-servicing Dealers* — Many dealers are not equipped to handle this service and follow up for their customers. They are looking for a reliable agency to properly handle this for them. I keep sending letters to dealers and I keep calling on them just to remind them regularly that "I am in the Television Service Business". It helps.

2. *Servicing Dealers*—Many servicing dealers find their customers are in my area and feel it is more economical to turn the service contract over to me. I really do good work and they are learning that I follow through. Because I don't sell new

ANTENNA REPORT

A PHILCO TELEVISION SERVICE MEMBER
124 RELIABLE AVE. YOURTOWN, U. S. A.

Date _____ Dealer _____

Name _____ Make _____

Address _____ Model _____

City _____ Serial _____

Apt. _____ Tel. _____ Date Installed _____

INSTALLATION

Installation Description

Roof Chimney

Wall mount Centralized

Standard Special

Other _____

TYPE, BUILDING & ROOF

Pvt. House Flat

Apt. House Sloping

Hotel _____

Other _____

RECEPTION REPORT

CH	GOOD	FAIR	POOR	REFL.	INT.	OTHER
3						
6						
10						

MATERIAL USED

Antenna Used _____

Est. Len. Line _____

Single Twinex Coaxial

Double Twinex Switch

NOTE--Indicate all data relative to installation description and reception difficulties on back of this report.

Installation Chief _____

" Helper _____

Date _____

REWORK

Customer's Complaint _____

As found before rework

CH	GOOD	FAIR	POOR	REFL.	INT.	OTHER
3						
6						
10						

Customer's Confirmation of Reception as shown above

Customer's Signature _____

AFTER REWORK

CH	GOOD	FAIR	POOR	REFL.	INT.	OTHER
3						
6						
10						

CUSTOMERS CERTIFICATION

I certify that the reception at my location is as Noted hereon after the antenna work was completed.

Customer's Signature _____

SERVICE ORDER

A PHILCO TELEVISION SERVICE MEMBER
124 RELIABLE AVE. YOURTOWN, U. S. A.

Efficient 9-0200 DATE _____

Received _____

Make _____

Name _____ Model No. _____

Address _____ Serial No. _____

City _____ Date Installed _____

Apt. No. _____ Telephone _____

Complaint	Sound	Picture	Raster	Antenna

Service Rendered _____ Time Required _____

Parts Used _____ Price _____

C. O. D. CHARGE **NO CHARGE** **CONTRACT** PLEASE PAY SERVICEMAN FOR ALL C. O. D. WORK

Received from _____

The sum \$ _____ for Parts and Service Rendered

Customer's Signature _____

Servicemans Signature _____

Typical service reports that may be used by a contractor. These go a long way in keeping a complete service history of the work done.

or used sets they aren't afraid I'll steal their customers. Lots of servicing dealers have limited equipment for service. They give me the overflow work. Many of them cannot handle certain difficult situations. That's where I shine. It's like a doctor turning certain cases over to a specialist.

3. *C. O. D. Accounts*—This is a really profitable source of my business. This customer is anybody's baby. He is out of warranty and can give his business to anybody. I find that by giving good service to sources 1 and 2 these people stay with me to become good C. O. D. accounts. They tell their friends about me. All my trucks carry my phone number and lots of people say "I saw one of your trucks across the street, can you take care of my set?" We try to get there the same day. We keep putting all our customers on a mailing list and every once in a while we send them a reminder that "I am in the Television Service Business". We also send out teasers in direct mail campaigns for new customers.

4. *Contracts from the Distributor*—I get quite a lot of tips right from the distributor because he knows I'll take good care of the business. He tells dealers about my work and con-

siders me a prime contractor. I don't go in much for servicing too many different makes of television sets because the handling of so many parts is quite a problem in itself. The ninety day warranty feature is right up my alley because the customer is more quickly converted to C. O. D. With my service facilities I seldom lose a customer and always get more and more new ones.

5. *Conversions*—I have developed recently a new source of income by advertising that my shop will convert a 10 inch set to a 14 inch rectangular set and a 12 inch to 16 inch for a specified charge depending upon the make and model.

6. *Multiple Antenna Installations*—Many apartment houses, hotels and large building owners have called upon me to install a master antenna distribution system. In addition to the installation, I receive a considerable amount of income from the maintenance of these systems.

7. *Dealer Installations*—Many large dealers and department stores which demonstrate quite a few receivers on the sales floor, use my service for setting up their display rooms. I usually install a multiple antenna system with distribution outlets to handle the required number

of "live" sets. In addition to this dealer business, I sometimes set up my antenna equipment temporarily for manufacturers who hold conventions and dealer meetings in my city.

Case History Of Typical Service Call

Here is what happens to a call that comes into my office:

1. The authorization form for installation and set-up is received from the Dealer.

2. A quick reference service card is made up for the customer that contains the following information.

- a—date
- b—name, address and phone number of customer
- c—name, address and phone number of dealer
- d—make, model and serial number of set
- e—type of warranty issued (this can be 90 day service, one year service or installation and set-up only)

3. A customer folder is made up that will, from then on, carry all reports and service calls, and other information relative to the customer.

4. The call is routed and assigned to the crew nearest that customer. I have found it practical and profitable

[Continued on page 44]

The C.B.S.

COLO

This article contains certain excerpts titled: "The present Status of Color are designed to give the reader a optical, mechanical, and electrical

Color disc used in converter manufactured by Webster-Chicago Corporation

THE addition of color values to a television picture involves the reproduction of the thousands of different colors which the eye can distinguish. This seemingly formidable task is vastly simplified by the fact, established in Newton's time, that all colors can be very closely represented by combining just three colors, known as primary colors.

There are two types of primary colors. When the reproduction is effected with layers of colored material, one on top of another through which light must pass in succession, the so-called "subtractive primaries" must be used to obtain a satisfactory range of mixture colors. The subtractive primaries are red, blue, and yellow. These are the familiar primary paint colors known to students in elementary school. Subtractive primaries are

used in oil and water-color paintings, in color printing, and in color photography (prints and transparencies). In color printing and photography, the primary colors used are a bluish red ("magenta"), a greenish blue ("cyan") and a greenish yellow. These subtractive primaries are the ones most commonly known to the public.

In color television, the reproduction is not effected with layers of colored material one over the other, but rather consists of individual lights of the primary colors presented one after the other in time sequence. For this type of color reproduction, the so-called "additive primaries" must be used. The additive primaries are red, blue, and green. If pieces of red glass and green glass are placed one beside the other (not one on top of the other) and white light is passed

through them in such a manner that the red and green light thus formed falls on the same area of viewing screen, the combined light will have a yellow color. If red, green, and blue glasses are similarly employed, the combined light on the screen will appear white, or near white.

With these primaries combined in proper proportions it is possible to reproduce any of the hues of the visible spectrum, plus purples which do not appear in the spectrum, plus all the shades of gray from white to black, as well as mixtures of the above. With only three primary colors it is not possible to reproduce all the spectrum colors exactly, but the color match can be made so close that only simultaneous inspection of the original color and the reproduction will reveal the difference. Experience with



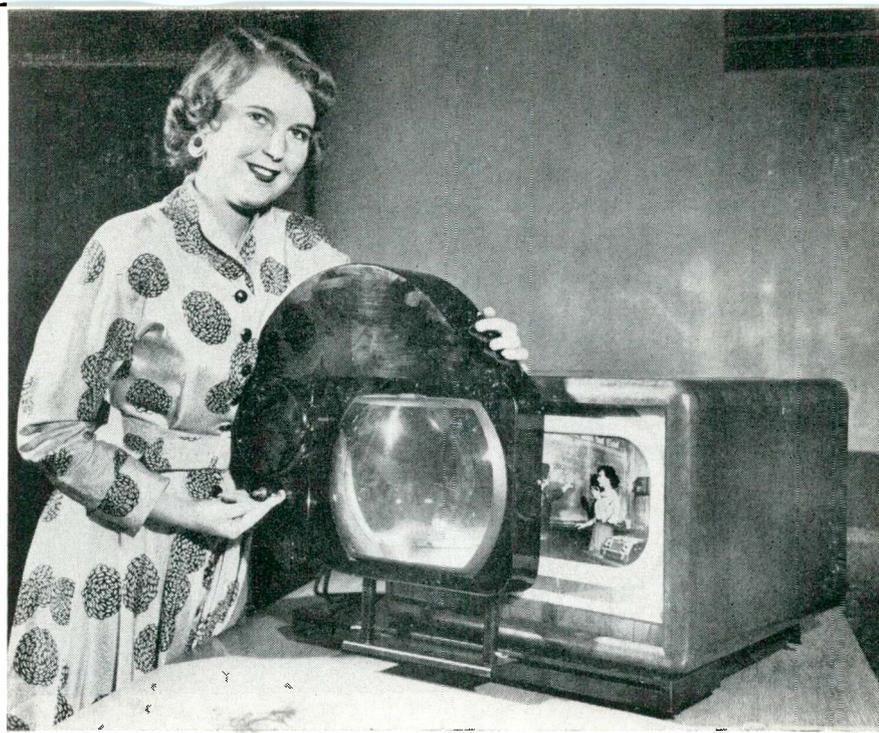
INVENTOR OF CBS COLOR TELEVISION

Fig. 1. Dr. Peter Goldmark, CBS Vice President and developer of the CBS color television system which has been selected by the FCC as standard, shown here with converter and adapter designed in the laboratories he directs. The circular device in front of the device of the ordinary black-and-white set, gives reception in color. The small box-like device to the right is the adapter, which changes the set from black-and-white to color standards. When watching black-and-white programs, the converter is slid to one side..

System of R TV

from Senate Document No. 197, on "Television". The excerpts chosen substantial background on the operation of CBS System of Color. TV.

Enclosed view of converter. Also needed will be circuit adaptations in receiver.



various types of color photography has shown, in fact, that a highly realistic rendition of natural colors can be achieved with three properly chosen primaries.

Since at least three primary colors must be used to achieve realistic color reproduction, it follows that three color images must be transmitted by a color-television system. The three color images are transmitted in sequence, hence the name "sequential color television system." In the dot-sequential system, the primary colors are assigned to successive dots of the image. In the line-sequential system, the primary colors are assigned to successive lines of the image. In the field-sequential system, the colors are assigned to successive fields of the image.

The manner in which the colors are interspersed is discussed in detail in the following chapters relating to the three systems. Here it suffices to say that three separate images, one in each of the primary colors, must be dissected in a particular sequence at the transmitter and assembled in the same sequence at the receiver. The dissecting and reassembling processes are performed so rapidly that the primary colors are not separately perceived one after the other, but appear to the observer to blend or "fuse," as though they existed simultaneously.

Thus, while it is true that only one primary color is actually present on the receiver screen at any one instant in each of the three sequential systems here described, persistence of vision causes the picture

screen to appear as if all three primary colors were present simultaneously throughout the area of the screen. We may then conclude that a color television image is equivalent to three images superimposed one on top of the other, each image being made up of light of one of the primary colors. As we shall see later, in each of the proposed systems the color images may be somewhat less detailed than the equivalent black-and-white image. But this is a difference merely of degree. In principle, a three-color television system employs the equivalent of three images, each

depicted in light of one of the primary colors.

The CBS scanning pattern

Figures 2 and 3 illustrate the manner in which the CBS field-sequential color-television image is scanned. In figure 2 is shown the conventional line-interlaced version of the system. Each picture consists of 405 lines, divided into two fields of 202½ lines each. The fields are scanned at a rate of 144 fields per second. As shown in the figure, all the lines in one field are scanned in blue, the next

[Continued on page 42]

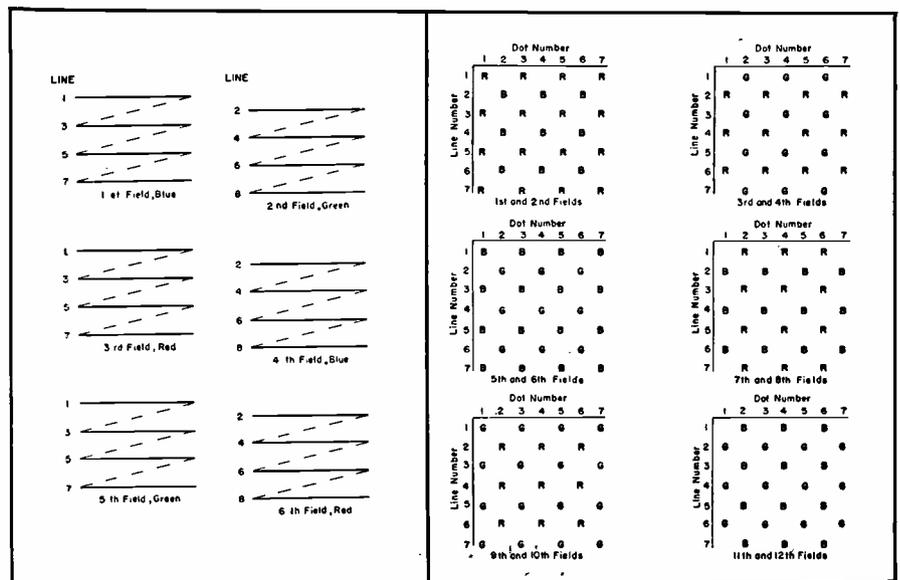


Fig. 2 (left). Scanning pattern for CBS field sequential color system line interlaced. (8 lines shown). Fig. 3 (right). Scanning pattern for CBS field-sequential color system, dot interlaced (7 lines and 7 dots shown).



A Studio for **SERVICEMEN**

by **ARTHUR LINDSEY**

Interior of receiver and sound studio of
the Hudson Radio and Television Corp.
available for servicemen.

**A unique service is offered to servicemen to permit them the use
of a beautifully decorated and well stocked studio for their sales.**

WE'VE heard so many small radio dealers and servicemen complain, "I could sell a million bucks worth of hi-fi sound equipment if I could only stock and demonstrate it." But an up-to-date sound department takes a lot of space and a big investment in stock and facilities that can hardly be carried by the average dealer. There's so much new sound equipment on the market which requires demonstration and comparison that it becomes extremely difficult to do a good selling job with limited facilities. Then, again, in many cases so many profitable sales are lost to the large stores because there is not sufficient local traffic to justify carrying a large stock. But what's the answer to this and other dilemmas of the radio service-dealer? One New York outfit has come up with a solution to some of these problems.

Hudson Radio and Television Corp., at 212 Hudson Street in New York has the answer! The plan may well be a model for other jobbers and distributors throughout the country. It recognizes the vast potential for new business for the serviceman and the moderately small service dealer.

In their unique plan, Hudson makes their vast facilities available for use by any serviceman or dealer for demonstration or sales purposes. Permission for use of the store will be granted upon request by Mr. S. Bennett, the manager. Thus, any serviceman can bring along his customer, use, demonstrate, and compare any

sound or other equipment, and actually make the sale right there. The firm stresses the fact that there is no obligation whatever for use of their facilities.

This interesting and helpful service is being provided primarily in the spirit of cooperation with smaller dealers. The owners of this progressive firm, Sol Baxt and Lester Klein, began their careers in radio as small operators. Therefore they appreciate the difficulties involved. Now that they are in a position to offer help, they have decided to provide their new service at no cost. An added feature enables the dealer-serviceman to obtain practically any standard radio, TV, sound or test equipment tubes and replacement parts at special dealer prices. Since Hudson Radio and Television Corp. is a direct distributor of many standard makes, they are in a position to offer these special discounts. But these prices are available only to legitimate dealers and servicemen.

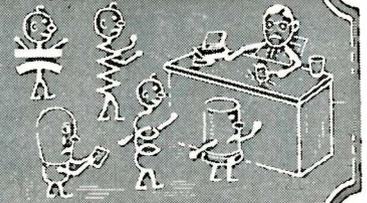
Now that high fidelity sound equipment has been developed to a point where practically anyone can own a fine system, more and more people are becoming aware of the existence and superiority of high fidelity reproduction. Here is a fertile field that lies waiting for the aggressive radio dealer—serviceman. Far greater in profit possibilities than either radio or television equipment, a sound installation in the home presents a

challenge to the ingenuity and salesmanship of the dealer. The vast selection of equipment available and the wide range of cost present an infinite number of assortments and refinements that are possible. Every listener is a prospect for some kind of equipment to improve the quality of his radio and record reproduction at home. And the tremendous popularity of "built-in" systems is bringing terrific profits to the dealers who go after these installations. Creating interest in hi-fi systems is being taken care of by a great many magazines and newspaper articles and by trade papers throughout the country.

The elaborate Sound Department shown here has every type of equipment for every purpose, including public address installation and transcription players for schools, churches, institutions, etc. Here, again, is a large field for local service-dealers to exploit by using such facilities to do their selling job. Not only is it possible to see and hear the products of all outstanding manufacturers, but customers are always impressed with the size and scope of a large showroom. This makes selling so much easier and leaves the customer satisfied that he has seen and heard everything.

Should he prefer, the serviceman can send his customer directly to the studio where experienced salesmen will do the selling job for him in strict confidence. Of course, in this case, arrangements can be made in advance regarding quotations, etc.

CIRCUIT COURT

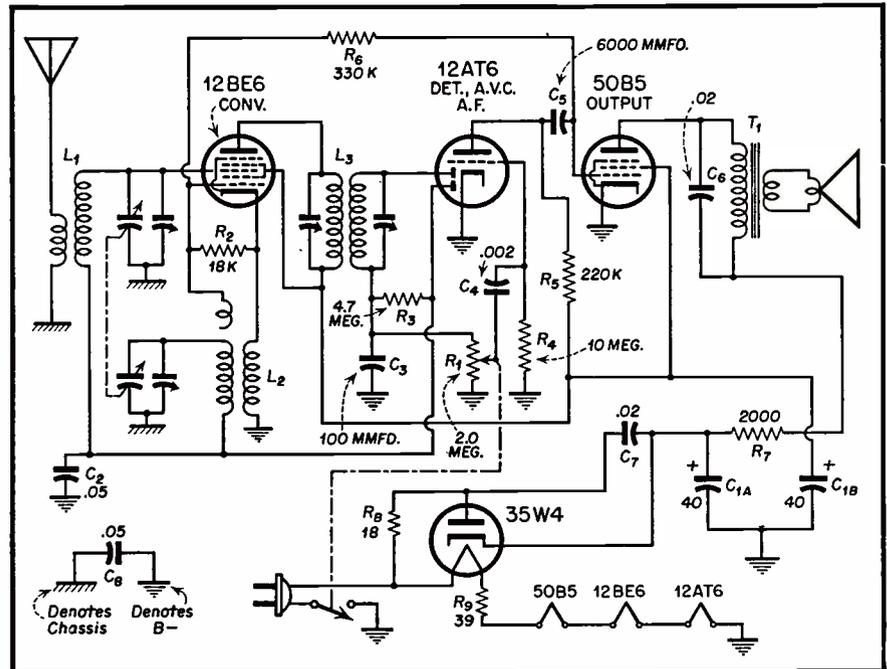


Aircastle Model 211

Any examination of the details of this 4 tube, a-c/d-c receiver almost necessitates examination of the complete schematic as it is shown here. The circuit involves just about the minimum number of components to provide loud-speaker reception from a power-line supplied instrument.

The signal is introduced into the set from a pick-up wire in place of the usual loop antenna. This has the advantage of providing for adjustment of the sensitivity to suit the locality by choosing an appropriate length of wire. Where signals are weak this method can provide a useable signal which cannot be equalled by a small loop.

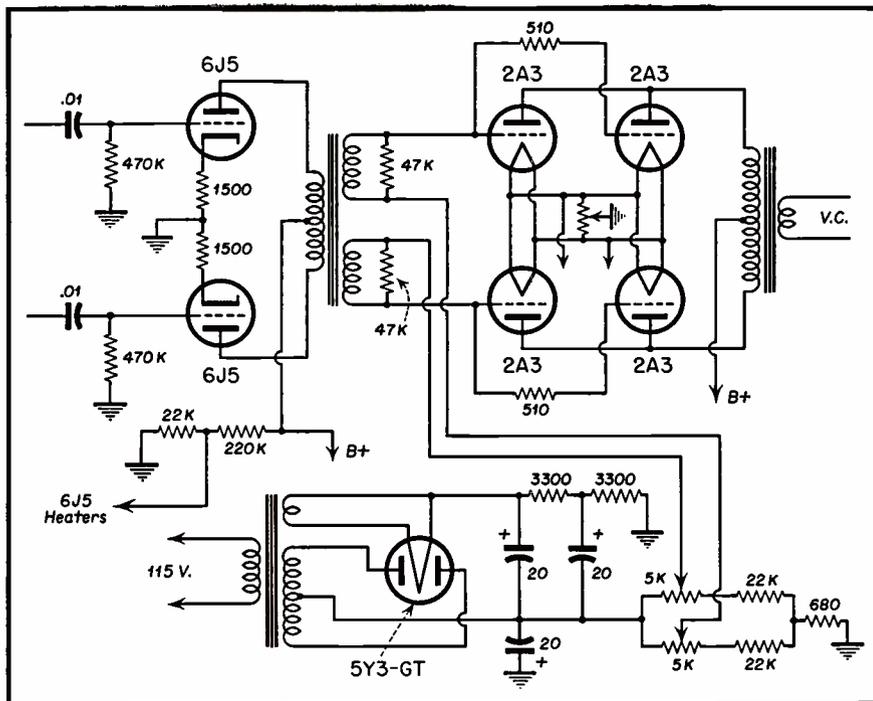
The 12BE6 converter stage is conventional, developing a 455 kc i-f signal. No amplification takes place at the i-f., it being fed directly to a diode of the 12AT6. Detection takes place, and AVC voltage for the converter is developed across the volume control. The second diode, connected after the 4.7 meg. filter resistor, stabilizes the AVC.



Complete circuit diagram of Aircastle Model 211.

Audio amplification takes place in the customary two stages, but an un-

usual feature is the use of fixed grid bias on the 50B5 output tube. This bias is picked up at the oscillator grid of the converter to which the 330K grid resistor returns. This feature makes it possible to make use of the full plate and screen voltages from the power supply, none being lost in a cathode bias resistor. It also saves the need for cathode bypass capacitor and resistor inclusion.



Partial schematic of Capehart Model 413P

Capehart Model 413P

This elaborate instrument incorporates 28 tubes and covers AM broadcast, short-wave and FM bands. Actually two complete receivers, one AM and one FM, precede the audio section. R-F and i-f and associated components are mounted on one chassis, while the final four audio stages and power equipment occupy another. One of the unusual features is the use of triode power output tubes. Once common, they have all but given way to the more efficient beam tubes.

A partial schematic, showing the output stage and bias supply, appears here. The tubes used are the time-proven 2A3 type, and four are em-

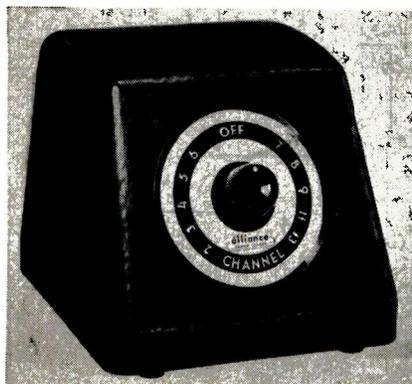
[Continued on page 49]

NEW PRODUCTS

NEW TV BOOSTER

John Bentis, Sales Manager of The Alliance Manufacturing Company, Alliance, Ohio has announced the addition of a new TV Booster which will be sold and advertised nationally in and around all television areas.

Tenna-Scope, which is a trade name for the Alliance Booster, features the following advantages claimed by the manufacturer: It has a single tuning control - one control covers all channels. It has an automatic

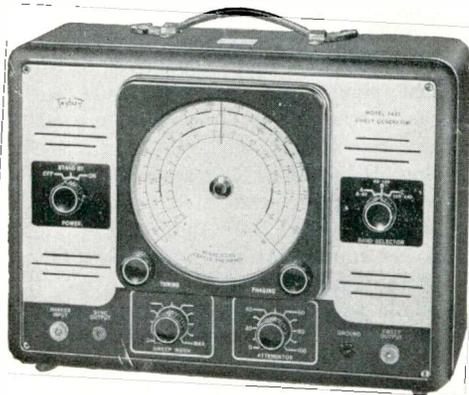


on-off switch. When the set is turned on, the Booster is ready to operate! There is no extra control. The Booster goes on and off with the control switch on the television receiver. High and low band amplifiers are separate circuits and each circuit is designed to give maximum performance on its own channels.

The Booster uses two tubes and another exceptional feature claimed by the manufacturer is the excellent balance and uniformity in the amplification of picture and sound.

SWEEP GENERATOR

This Triplett Model 3435 Sweep Generator provides continuous range coverage to 240 MC for all TV Carrier and IF Frequencies. No gap in frequency and continuous tuning provided over all TV and FM Bands. The main Frequency dial is marked with channels as well



as frequencies. Any good AM Signal Generator may be used with the model 3435 as a marker.

Continuously variable Sweep width, effective from 500 kc to 12 mc, with OFF position.

Phase controlled Sweep voltage for Scope horizontal input. Standby switch for temporary silencing of Generator during other work on equipment under test.

Copper plated steel construction throughout. Critical circuits enclosed. Static shielded power transformer. Best available components used throughout, including ceramic capacitors for all trimmer, coupling and bypass applications.

Write for additional information on Triplett Model 3435 TV-FM Sweep Generator, to The Triplett Electrical Instrument Co., Bluffton, Ohio.

NEW KIT

Specifically designed for the trouble-shooting and demonstration of all auto radios—in on-the-spot or bench work — the new Model 1040-K Battery Eliminator, Booster & Charger Kit, latest addition to the EICO line of instruments and kits, is a modern professional 6-volt power supply. It features extra reserve electrical power, excellent versatility and several noteworthy departures from contemporary eliminator design.

The Model 1040-K has a continuous rating of 10 amperes at 5-8 volts, and an intermittent rating of 20 amperes. The 10,000 mfd condenser provides an excellent filter.



As with all EICO Kits, Model 1040-K is supplied complete with all nationally famous brand-name electronic and mechanical components, and easy-to-follow step-by-step comprehensive pictorial and schematic assembly instructions. Its dimensions are: 10½ x 7¾ x 8¾.

For further details on this and the rest of the complete EICO line, write directly to Electronic Instrument Company, Inc.

NEW 7-INCH 'SCOPE

A new 7-inch cathode ray oscilloscope which has been specially designed for general use in radio and television receiver testing and in laboratory and production applications has been announced by the Radio Tube Division, Sylvania Electric Products Inc., 1740 Broadway, New York 19, New York.

The new instrument incorporates a multivibrator sweep circuit for linear internal sweep from 10 to 30,000 cycles which may be synchronized to 60 cycles, an external signal or signal applied to its vertical input terminal. Balanced, non-astigmatic sweep is assured by push-pull deflection. Terminals are provided for direct connection to horizontal and vertical deflection plates and to the control grid of the cathode ray tube for intensity modulation.



The vertical deflection amplifier provides a sensitivity of .1 volt rms for one inch peak-to-peak deflection; sine wave frequency response at full gain flat within 3 db of 1000 cycles value from 7 to 70,000 cycles free of peaking and useable to much higher frequencies; and an input impedance of 1/2 megohm and 34 mmf.

The horizontal deflection amplifier provides a sensitivity of at least .25 volt rms for one inch peak-to-peak deflection; sine wave frequency response within 3 db from 7 to 120,000 cycles; a total deflection of at least 8½ inches with negligible distortion; and input impedance of ½ megohm and 34 mmf.

Horizontal sweep characteristics include: linear (multivibrator) saw-tooth sweep, left right, from 10 to 30,000 cycles; non-linearity not exceeding 10% between rated limits at any sweep frequency; and response to positive synchronizing signals.

NEW 19 INCH TUBE

Radio Corporation of America announces a new tube, the 19AP4-B which is a directly viewed picture tube of the metal-cone type for use in television receivers. It has a high-efficiency, white fluorescent screen on a face made of frosted filterglass to provide increased contrast and reduced specular reflection. Utilizing magnetic focus and magnetic deflection, the 19AP4-B provides pictures of high quality.

The frosted Filterglass face plate incorporates a neutral light-absorbing material which reduces ambient-light reflections from the phosphor and reflections within the face plate itself in a very much higher ratio than it reduces the directly viewed light of the pic-



ture. As a result, improved contrast is obtained. In addition, frosting of the face diffuses any reflections from bright objects which might otherwise be objectionable.

A rounded-end picture 17-3/8" is obtained by utilizing the full-screen diameter; or a rectangular picture 15-5/8" x 11-3/4" with

rounded corners is obtained within the minimum-useful-screen area.

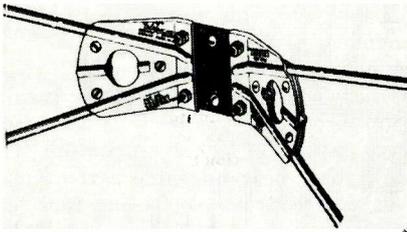
Use of the metal cone not only makes practical a construction which weighs substantially less than a similar all-glass type, but also makes practical the use of a higher quality face plate than is commonly used on all-glass tubes.

The 19AP4-B has a reflection angle of approximately 66°, large screen area in relation to tube diameter, an ion-trap gun which requires only a single-field, external magnet, and a small-shell duodecal 5-pin base.

Except for its frosted face, the 19AP4-B is identical with and directly interchangeable with the 19AP4-A.

NEW TV ANTENNAS

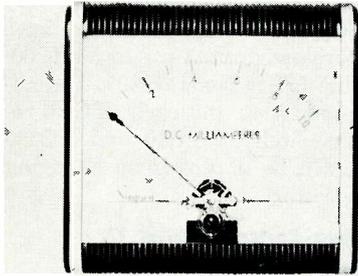
Telrex, Inc., Asbury Park, N. J., manufacturer of "Conical-V-Beams", announces the addition of a new "Monarch" series combining the versatility of its "Universal" models and the outstanding constructional and electrical features of its famous De Luxe series.



The Telrex "Monarch" series of "Conical-V-Beams" will be available in single, double and four bay models designed as K2X-TV, K4X-TV and K8X-TV. All models will be furnished with dowelled, heat treated dural tubular elements or optionally, with solid dural rods.

PANEL INSTRUMENTS

The Simpson Electric Company, 5200 W. Kinzie St., Chicago, is now making a line of modernistic panel instruments in three different sizes to supply customers with a complete line of both conventional and modernistic design.



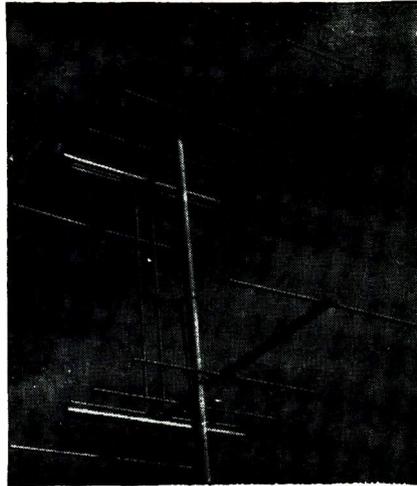
These models, which were designed by Ray Simpson, come in 4 1/2, 3 1/2 and 2 1/2 inch sizes. The design is identical on all three sizes. Model numbers are, 1029, 1027 and 1127.

The large, easy to read scale provides greater readability under all light conditions. Etched faces extend across the entire fronts of the meters and are protected with unbreakable plastic. Vertical chrome-plated strips are recessed into the plastic, fluted cover.

5-ELEMENT YAGI

A new 5-element Yagi Antenna tuned for any one of the low-band (2-6) or high-band (7-13) channels is announced by Technical Appliance Corporation, Sherburne, N. Y., manufacturers of antenna systems.

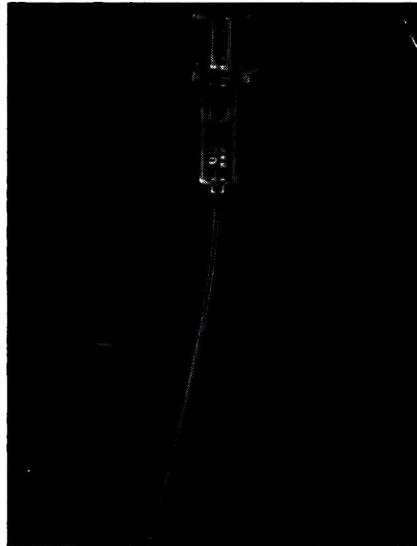
Three directors, antenna element and reflector designed and manufactured to most efficient dimensions electrically, assure fine per-



formance in fringe and sub-fringe areas. Extremely high front-to-back ratio and pinpoint directivity inherent in the Yagi design minimize ghost effects caused by reflected signals. Deliver 11 db gain by actual field measurement.

USEFUL LUBRICATOR

The Walter L. Schott Company of Beverly Hills and Chicago have introduced their plastic "Lubricator", designed to reach the many cramped and inaccessible points in radio and television sets and record changers.



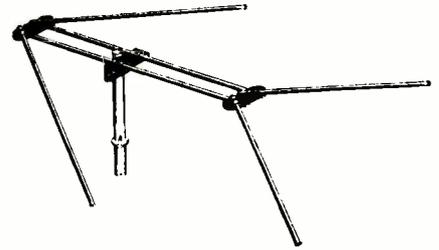
This handy tool can be used with light greases and solvents for cleaning and lubricating TV tuners and record changers. Hypodermic syringe-type construction allows release of the desired amount of lubricant. The long plastic tip is flexible and may be bent to any position for efficient lubrication.

TV ANTENNAS

Two new TV aeriels have been added to the Snyder Mfg. Co. Head-Line series of antennas, it was announced by Dick Morris, salesman of the Philadelphia TV, radio and automotive accessories firm.

One of the Snyder products is the Double-V Servicemen's Array. Coded the AR-55, it is for installation crews supplying their own accessories. Of hi-gain for fringe areas, the AR-55 features four hi-tensil 3/8" aluminum alloy elements, two 1/2" aluminum alloy cross arms and comes completely pre-assembled.

Second of the new Snyder aeriels is the completely pre-assembled Double-V, TV-55 Kit. Hi-gain for fringe areas, it has four hi-tensil 3/8" Aluminum Alloy elements, two 1/2" Aluminum Alloy cross arms and comes complete with two mating 1-1/4" zinc plated



lock-seam steel mast sections, 7 feet erected, and guy ring.

TV COMPONENTS

General Electric has announced a complete new line of television receivers parts, applicable to G. E. and to many other receiver makes.

The new line includes 70 degree deflection yokes for magnetic deflection circuits; horizontal sweep output and high voltage trans-

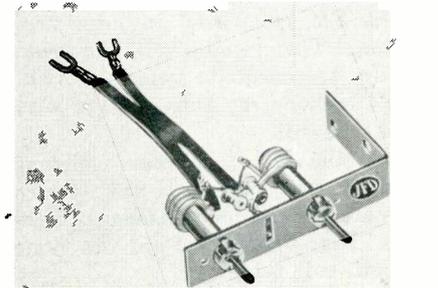


formers, and other components such as EM-PM focus coils, width and linearity, ion trap magnets, etc.

A new catalogue is now available which gives a complete description of the various components and may be obtained from the Parts Section, G.E. Receiver Division Electronics Park, Syracuse, N. Y.

TV WAVE TRAPS

To assist servicemen in solving the widely prevalent problem of television interference, the JFD Manufacturing Co. Inc. of Brooklyn announces the production of its new "Clear-Beam" series of Wave Traps.



Designed to filter out FM image and amateur harmonic interference easily and effectively, JFD "Clear-Beam" Wave Traps are available in four separate models to meet diverse receiving conditions.

The JFD Wave Traps are installed by attaching the lead to the antenna input terminals in parallel with the transmission line and tuning the coils until the interference is eliminated. Literature describing the new JFD Wave Traps is available from the manufacturer.

SHOP NOTES

Westinghouse Model H-223—

Picture Interference

In early production of Model H-223, one side of the audio output transformer secondary winding was connected to the chassis near the transformer, and one of the speaker socket terminals was connected to the chassis near the socket. With these connections, the audio output currents were carried through the chassis for some distance, and under certain conditions disjoined or random sound bars appeared on the picture.

The remedy is to disconnect the transformer secondary wire at the point where it connects to the chassis and connect it to the grounded terminal of the speaker socket through an additional length of wire. This is being done in later production.

Westinghouse Model H-223—

Permanent Magnet Type Focus Coil

Permanent magnet type focus coils were employed on some of the early production chassis. Coils of this type can be identified by the part number V-6456 stamped on the coil. Care should be exercised to avoid bringing another magnet into contact with the coil, because prolonged contact will alter the magnetization and affect the amount of current required for correct focusing. The focus control range will then be insufficient.

With the PM focus coils, the centering range is less than that afforded by the EM coils used in later production. The range will, however, usually be adequate when a G.E. 10BP4 cathode ray tube is used with a PM type coil.

Only the EM type focus coils as listed in the Model H-223 service notes are stocked for replacement purposes. The connections are the same for both coil types.

Westinghouse Model H-223—4.5

Mc. Audio I-F Transformer

In early production, the audio I-F transformer (V-6517) did not contain a 10 mmf capacitor (C220). Instead, the capacitor was located outside the transformer can. These transformers that do not contain C220 are coded with a red dot.

Although the part number of the audio I-F transformer was not

changed, the capacitor was built into the transformer in later production.

The transformers supplied as replacements contain the capacitor. Therefore, when replacing one of the red-dotted transformers, the external capacitor should be removed from the circuit.

*Westinghouse Electric
Service Dept.*

Sentinel Models 412, etc.

Omission of Diagrams

In Sept. Shop Notes

The following diagrams referring to the Sentinel Shop Notes in the Sept. RSD where omitted in the discussion.

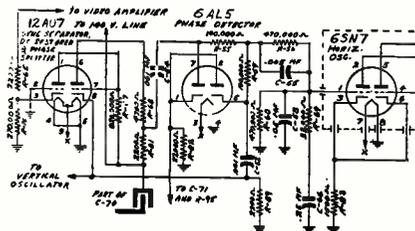


Fig. 1. Circuit used in "Series" YA, YB, YC, YD, YE, and YF chassis.

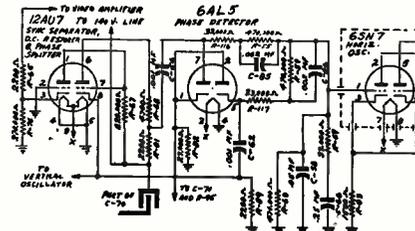


Fig. 2. Circuit used in chassis having "Series YG" ink stamped on back of chassis.

Stromberg-Carlson Model TC19

Receivers—High-Voltage Connector Lead.

Loss of the anode high-voltage to the kinescope tube often occurs because of poor contact at the junction of the male-female high-voltage connectors. These connectors should be firmly pressed together to assure positive contact. In addition, this connector lead should be dressed away from any miniature tubes to prevent heat deterioration of the connector-lead insulation, which could result in shorting of the high-voltage. This high-voltage connector lead should be dressed on the side of the multi-lead

cable away from the 12AU7 tubes. (This multi-lead cable is the one that plugs into the top of the main chassis.)

Stromberg-Carlson Model TC19

Receivers—Component Failure.

Early production of these receivers were subject to failure of the C231 and C232 (500-mmf., 15,000-volt, Part No. 110595) capacitors in the high-voltage supply, and short circuiting in the L3 Deflection Coil Assembly (Part No. 114672) when internally developed heat-deteriorated the insulation between windings.

The subject capacitors have been replaced in production by a new type capacitor with smooth sides, that is a 500-mmf., 20,000-volt unit (Part No. 110680). When replacing capacitors in the field, this new part is recommended.

A new deflection coil assembly (yoke) is now being used with better insulation properties as well as an open-type casing for better ventilation. The new yokes bear the same part number but are recognizable by the well-ventilated yoke body. When replacing yokes in the field, this ventilated yoke is recommended. In addition, it is recommended that the protective plastic funnel sleeve between the yoke and cathode-ray tube neck be removed entirely for better ventilation.

Stromberg-Carlson Model TV 125 And

TC19 Receivers—Improved Signal to Noise Ratio at the Sound Detector for Better Audio Reproduction.

To improve the signal to noise level at the ratio-detector stage for clearer audio reproduction, the C133 (TC19) and C56 (TC125) capacitors have been increased from 1-mf to 5-mf, 50-volt value (Part No. 111030). The audio reproduction on early TC19 receivers, as well as TC10 and TC125 models, can be improved by changing this capacitor.

Stromberg-Carlson Model TV

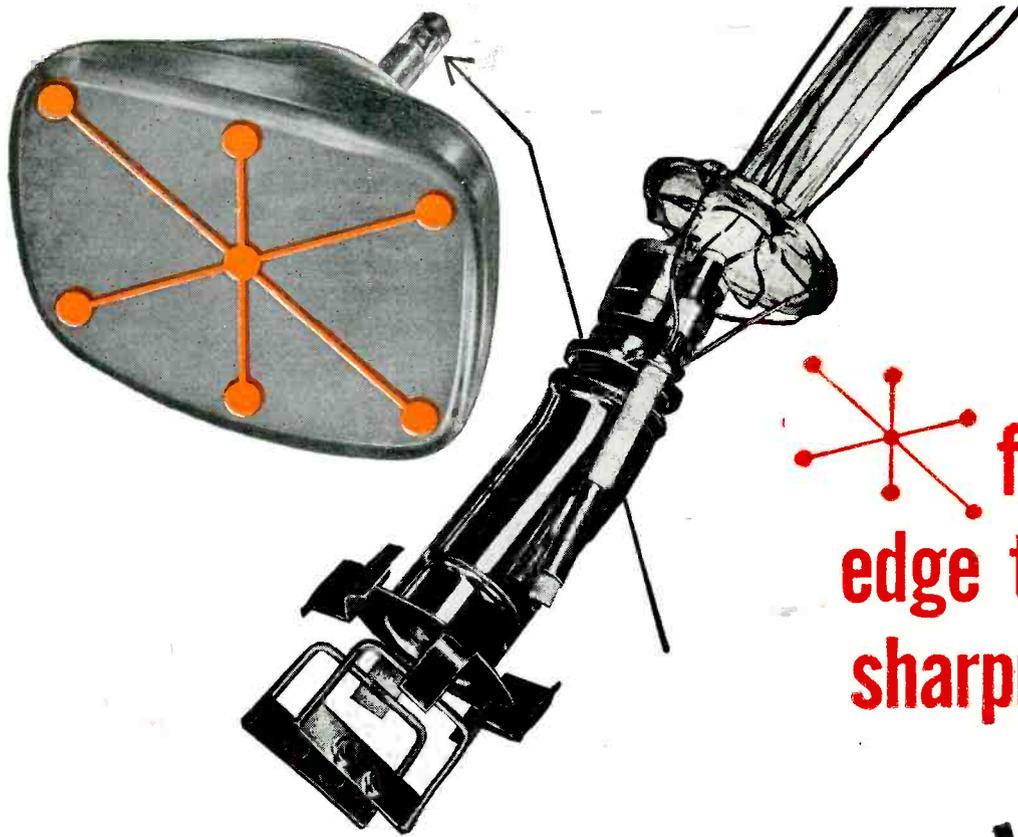
Receivers—Horizontal Picture

Instability.

Cases of horizontal instability or "jitter" in the picture have been encountered where the L4, Horizontal Oscillator Coil (Part No. 114069) has developed short-circuited turns. This condition lowers the Q of the coil in turn lowering the stability of the horizontal oscillator. This situation is best remedied by replacement of the coil.

A leaky 270-mmf capacitor between the No. 1 and 5 pins of the 6SN7 Horizontal Sweep Oscillator will produce a similar condition.

*Stromberg-Carlson
Service Dept.*



for
edge to edge
sharpness...

the **New** Du Mont Bent-Gun

Uniform sharpness of trace to the very edges of the screen distinguishes the new Du Mont Bent-Gun.

A higher degree of pre-focusing passes a smaller-diameter beam through the deflection field. Spot distortion is reduced and a uniform overall focus results. Other design changes are: Improved bulb spacer insures proper anode contact and electron gun centering; rounded corners on pertinent gun parts eliminates stray emission at higher anode voltages; new grid-cathode assembly allows a longer G-2 (second grid) without increasing overall length.

This new Du Mont Bent-Gun is now being incorporated in ALL Du Mont Teletrons. Therefore, whether planning a new TV receiver or modifying an old one, be sure to include the Du Mont Teletron for the best in TV pictures. Simply specify DU MONT.

RADIO-TELEVISION SERVICE DEALER • NOVEMBER, 1950

FIRST WITH THE FINEST IN **T-V** TUBES

DU MONT

*Teletrons**

ALLEN B. DU MONT LABORATORIES, INC.,
Tube Division, Clifton, N. J.

*Trade-mark.

CBS COLOR

[from page 35]

in green, and so on in the sequence red, blue, green.

After six successive fields have been scanned, every dot in the image has been scanned in all three primary colors. Consequently, the whole scanning sequence occurs at a rate one-sixth as great as the field-scanning rate, that is, $144/6=24$ complete scanning cycles per second. The complete scanning cycle is termed a "color picture." The color-picture rate

of the CBS system is, accordingly, 24 per second.

In the dot-interlaced version of the CBS system (fig. 3) each line is broken up into dots, all of the same primary color, with blank spaces of equal size between the dots. These blank spaces are filled in with dots of another primary color, on the next successive scanning of that line. Consequently, a given dot in the image is scanned in all three colors only after 12 consecutive fields have been scanned, and the complete scanning cycle occurs at a rate of $144/12=12$ color pictures per second. The corresponding color picture rate of the

CTI line-sequential system (sec. 16) is 10 per second, and that of the RCA dot-sequential system (sec. 26) is 15 per second.

Essential apparatus of the CBS system

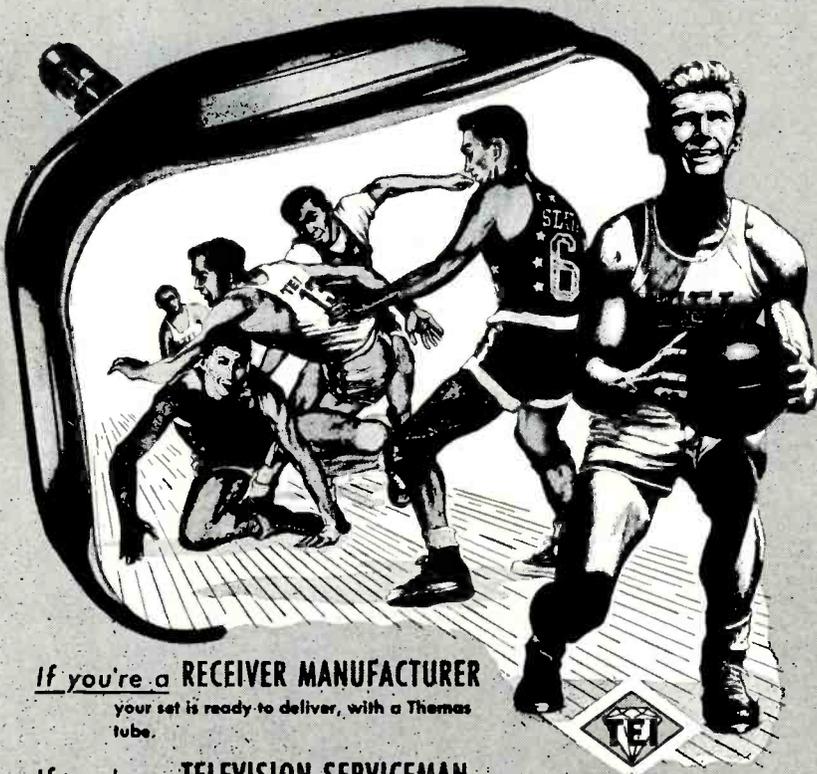
The CBS color camera employs one image orthicon camera tube and one lens. Between the lens and the sensitive plate of the camera tube is located a filter disk containing six transparent filter segments, two for each of the three primary colors. The disk rotates at 1,440 revolutions per minute, so the filter segments move past the sensitive plate at a rate of 144 segments per second. The disk rotation is synchronized with the 144-per-second field-scanning rate of the camera. In this manner all the lines in one field are illuminated in red light, the lines of the next field in blue, and the lines of the third field in green, and so on, in the sequence red, blue, green.

These elements of the CBS camera are the same in the line-interlaced and dot-interlaced versions of the system. In the dot-interlaced version, the electrical output of the camera is rapidly switched on and off. The camera is thus effectively connected to the circuit during the scanning of a particular dot, and is disconnected during the scanning of the adjacent blank space, then reconnected for the next dot, and so on. The rate of connecting and disconnecting the camera is about 9,000,000 per second (9 megacycles).

Two types of receiver have been demonstrated by CBS. In the first a rotating filter disk, similar to that used in the camera, is positioned before the screen of the picture tube. This disk carries six filter segments, two in each of the three primary colors. The disk rotates at 1,440 r.p.m. and is synchronized with the 144-per-second field-scanning rate of the receiver. The image formed on the screen of the picture tube is displayed in white light, and this light, passing through the colored filters, takes on successively the three primary colors. Thus, the light emerging from the receiver is red on one field, blue on the next successive field, and green on the third, and so on. By means of synchronizing impulses, the position of the receiver filter disk is controlled so that red light is produced by the receiver only when the red filter is positioned before the camera tube at the transmitter, and similarly for the other two colors.

The system thus comprises two filter disks rotating in rigid synchronism, so positioned that the filters before the camera and the picture screen have the same color at any instant.

Get set for **ACTION!**



If you're a RECEIVER MANUFACTURER

your set is ready to deliver, with a Thomas tube.

If you're a TELEVISION SERVICEMAN

you're prepared to send these use-worn receivers back into the game fresh and rarin' to go, with a Thomas tube.

If you're a JOBBER OR DISTRIBUTOR

you're stocked to meet servicemen's increasingly heavy demands for the fastest-moving tube in the game, with Thomas tubes.

For, business-wise and performance-wise, "Action" in television picture tubes demands Thomas — the strongest tube in anybody's line-up!

THOMAS ELECTRONICS, Inc.

118 Ninth Street

Parsippany, New Jersey



12 Improvements IN NEW 1951

MODEL O-6

PUSH-PULL

Heathkit OSCILLOSCOPE KIT



Only **\$39⁵⁰**

New INEXPENSIVE MODEL S-2 ELECTRONIC SWITCH KIT

Twice as much fun with your oscilloscope — observe two traces at once — see both the input and output traces of an amplifier, and amazingly you can control the size and position of each trace separately — superimpose them for comparison or separate for observation — no connections inside scope. All operation electronic, nothing mechanical — ideal for classroom demonstrations — checking for intermittents, etc. Distortion, phase shift and other defects show up instantly. Can be used with any type or make of oscilloscope. So inexpensive you can't afford to be without one.

Has individual gain controls, positioning control and coarse and fine switching rate controls — can also be used as square wave generator over limited range. 110 Volt transformer operated comes complete with tubes, cabinet and all parts. Occupies very little space beside the scope. Better get one. You'll enjoy it immensely. Model S-2. Shipping Wt., 11 lbs.



Only **\$19⁵⁰**

- ★ New AC and DC push-pull amplifier.
- ★ New step attenuator frequency compensated input.
- ★ New non frequency discriminating input control.
- ★ New heavy duty power transformer has 68% less magnetic field.
- ★ New filter condenser has separate vertical and horizontal sections.
- ★ New intensity circuit gives greater brilliance.
- ★ Improved amplifiers for better response useful to 2 megacycles.
- ★ High gain amplifiers .04 Volts RMS per inch deflection.
- ★ Improved Allegheny Ludlum magnetic metal CR tube shield.
- ★ New synchronization circuit works with either positive or negative peaks of signal.
- ★ New extended range sweep circuit 15 cycles to over 100,000 cycles.
- ★ Both vertical and horizontal amplifier use push-pull pentodes for maximum gain.

The new 1951 Heathkit Push-Pull Oscilloscope Kit is again the best buy. No other kit offers half the features — check them. Measure either AC or DC on this new scope — the first oscilloscope under \$100.00 with a DC amplifier.

The vertical amplifier has frequency compensated step attenuator input into a cathode follower stage. The gain control is of the non frequency discriminating type — accurate response at any setting. A push-pull pentode stage feeds the C.R. tube. New type positioning control has wide range for observing any portion of the trace.

The horizontal amplifiers are direct coupled to the C.R. tube and may be used as either AC or DC amplifiers. Separate binding posts are provided for AC or DC.

The multivibrator type sweep generator has new frequency compensation for the high range it covers; 15 cycles to cover 100,000 cycles. The new model O-6 Scope uses 10 tubes in all — several more than any other. Only Heathkit Scopes have all the features.

New husky heavy duty power transformer has 50% more laminations. It runs cool and has the lowest possible magnetic field. A complete electrostatic shield covers primary and other necessary windings and has lead brought out for proper grounding.

The new filter condenser has separate filters for the vertical and horizontal screen grids and prevents interaction between them.

An improved intensity circuit provides almost double previous brilliance and better intensity modulation.

A new synchronization circuit allows the trace to be synchronized with either the positive or negative pulse, an important feature in observing the complex pulses encountered in television servicing.

The magnetic alloy shield supplied for the C.R. tube is of new design and uses a special metal developed by Allegheny Ludlum for such applications.

The Heathkit scope cabinet is of aluminum alloy for lightness of portability.

The kit is complete, all tubes, cabinet, transformer, controls, grid screen, tube shield, etc. The instruction manual has complete step-by-step assembly and pictorials of every section. Compare it with all others and you will buy a Heathkit. Model O-6. Shipping Wt., 30 lbs.

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E 40th ST.
NEW YORK CITY (16)
CABLE ARLAB N Y

The **HEATH COMPANY**

BENTON HARBOR 12, MICHIGAN

It is not considered feasible to use a rotating disk with picture tubes exceeding about 12½ inches in diameter because of the physical size of the disk involved.

SHOP OVERHEAD

[from page 33]

to give new installations fire-alarm service because the customer is on pins and needles until that beautiful receiver she has purchased is "hooked up". I know darn well my installation crew will show her exactly how it works after it is set up.

5. When the job is completed to the customer's satisfaction she signs

the completion slips. The installation man verifies the serial number and calls the customer's attention to the sticker he has placed on the rear of the cabinet. This sticker has my phone number. My man then asks for permission to place a similar sticker in her handy phone book under "S" for Service. The customers are very happy to give permission.

6. Completion slips are then returned to the office, checked off the service route sheet, stamped COMPLETED and turned over to the bookkeeper for billing. A copy of the completion slip with the customers signature accompanies the bill.

7. As soon as payment in full is

received from the dealer a service contract is made up and forwarded to the customer.

8. The completion slip is used to check the serial number against the customer's quick reference card. The type of service contract issued to the customer is indicated on this slip and it is then placed in the customer's case history folder.

Case History Of A Customer's Service Call

1. Both girls take calls for service on the telephone. Both are situated so that they have easy access to the customer quick-reference file. While talking to the customer it is easy to verify the status (that is whether it is C.O.D. or contract). In every case the young lady tries to find out the exact nature of the complaint. Complete information in this regard is very helpful to the serviceman. If the call is C.O.D. the service is explained to the customer to avoid misunderstanding later.

2. A service request form is made out which is then routed to the proper serviceman and from here on the same procedure is followed as was outlined before. C.O.D. calls are the most profitable for the consumer and for the service agency. Because of the large number of the requests for after warranty service policies I find it expedient to go after that business. My servicemen are paid a bonus for every service contract they sell. This provides considerable incentive as it results in extra dollars in the weekly check.

Facts And Figures

Salaries for personnel as given by "Mr. X" are as follows:

Bookkeeper	\$50.00 per week
Shop Trouble Shooter	\$90.00 per week
Shop Benchman	\$65.00 per week
Antenna Men	\$50.00 per week
Antenna Helpers	\$35.00 per week
Servicemen	\$65.00 per week

Rent is \$130.00 per month which I feel is a little high. As I indicated before, I'm interested in cutting this item down by moving to a lower rent location with larger facilities.

Overhead is \$120.00 per month. This covers heat, light, telephone, depreciation, etc., but not including payroll tax.

Quoting "Mr. X", I have the following Customers on my book:

755—under contract

1100—out of contract

17—dealers for whom we

do service work.

"My inventory totals \$2100.00 on parts, tubes, antennas and supplies. My installations average 6 per day. These installations include a thorough complete job, installing the antenna,

OXFORD Speakers

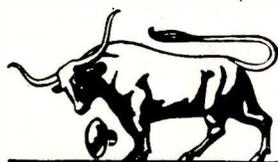
Constant research and development have made each and every OXFORD SPEAKER the outstanding unit of the industry. This is proved by the fact that over 77 television and radio manufacturers have used millions (yes — millions) of OXFORD SPEAKERS in the last 25 years.

The excellent engineering skill, fine sound reproduction, quality of components and durability of design, are just a few of the many reasons that make OXFORD SPEAKERS worthy of your consideration.

Precision-built for every sound application with the guarantee of unsurpassed performance, truly make Oxford Speakers **OUTSTANDING**.

Write for your free copy of our new catalog today—for the most complete speaker line available.

Leading jobbers carry OXFORD SPEAKERS for TV, FM, AM, AUTO and PA.



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More light on the
radio tube situation . . .

AN OPEN LETTER TO RADIO SERVICE DEALERS

SYLVANIA ELECTRIC PRODUCTS INC.

IMPORIUM • PENNSYLVANIA

First of all, we want to thank all of you good service dealer friends for your loyalty and cooperation.

Here are the FACTS: Even before the Korean trouble, the increasing demand for Sylvania Tubes was keeping our factories on round-the-clock production schedules. With the meteoric growth of television, still greater production facilities were needed.

Since the Korean war a flurry of buying by industrial customers and the service industry alike soon reduced warehouse and factory stocks to an all-time low.

Here's how Sylvania protects you now: To make certain that all of its regular service dealer customers are protected in this period of limited supply, Sylvania has effected a three-fold program of protection.

1. Production facilities have been greatly increased. Two additional plants have already been placed in operation. Another is under construction.
2. Your Sylvania radio and television tube suppliers are now being taken care of on an allocation plan, which we feel is established on the fairest possible basis.
3. Sylvania will continue to supply you with complete technical information for your service work, including latest data on substitution of available types for critical types.

Sylvania realizes that in the months ahead the whole country will depend upon you service dealers to keep its radios, TV sets and communications equipment in top working order. Your Sylvania Distributor will not have all the tubes you want but will do his best to serve you. We feel a deep obligation to give you the greatest possible aid in doing this job, but naturally, our country's defense needs come first.

As we have demonstrated in the past, Sylvania is ever mindful of the importance of its Service Dealers and servicemen to the nation and to the industry. We will continue to do everything possible to preserve the fine relationship existing between Sylvania, its distributors, and you, its loyal dealer customers.

Cordially yours,
H. H. Rainer
Manager, Distributor Sales

INCANDESCENT LAMPS • RADIO TUBES • FLUORESCENT LAMPS AND ELECTRODES • ELECTRONIC DEVICES

connecting to the set, checking to make sure it is working properly, and most important demonstrating to the customer. This thoroughness, we have found, results in more customers. Service calls average 7 per man per day. These are completed calls where the job is finished in the initial call. I schedule 9 calls per day to each man. Shop repair jobs average 9 per day. These jobs do vary from month to month because everything depends on the type of set and the nature of the complaint. Putting in a new tube, for example, is far different from putting in an entire new power sys-

tem. My average figures do not include dealer calls and calls that I make myself. I like to contact my dealers regularly, particularly those where I get all the service work. I also handle certain jobs that can be classified as special class.

"My average dollar volume is \$5000 per month. This does not include the unspent portion of warranty contracts; for example: A \$60.00 one year contract is put in the bank and held as a reserve. I draw only 1/12 per month or \$5.00 for each set we have to service. 100 installations at \$60.00 each is \$6,000.00 in the bank. I show

only 1/12 of this amount each month as earned income.

"My profit picture for the first nine months of operation wasn't too bright. Yours may not be either because you'll be concerned with some extra cost items at the beginning as we were (setting up the business, making improvements in the building, painting, etc.). I expect to make an average of \$1000 per month net profit next year. Here are a few more figures you probably will be interested in:

"My initial investment was \$10,000:
 \$2500 for inventory
 \$3600 for two trucks (two additional are rented)
 \$1206 office & shop equipment
 \$726 improvements on building
 \$618 insurance
 \$120 advertising
 \$150 incorporation expense

"At the moment my break even point is \$4400 per month. It costs me \$2.90 to make a service call (that's figuring men, trucks, and overhead). My call backs are about 10% of which half are no fault of our service. In these cases we carefully explain that the new complaint had no bearing on the last fix. After reaching an understanding with the customer we have no difficulty in getting paid for another service call. In one case out of 20 we find it necessary to re-fix. This we do cheerfully and create considerable good will.

"My charge for a Service Call is \$5.00. At this fee we give the customer up to a 1/2 hour in the home. Extra time is charged at \$5.00 per hour. All parts and material are additional.

"For work that needs "shop" service my charge is \$5.00 for pick-up and delivery and shop rates are \$5.00 per hour additional.

"Standard antenna installations are \$32.50. This includes the aerial and supplies. Special installations are based on the standard antenna charge plus time and material.

"Antenna repairs are \$10.00. This gives the customer up to 1-1/2 hours. For additional time my charge is \$5.00 per hour."

Conclusion

"Mr. X" also gave information on several things which are so important to servicemen, such as, a reminder that a reserve fund should always be established in good months to offset a possible deficit in bad months.

He says that he finds that all manufacturers have different warranty forms for expediting the replacement if defective "in warranty parts." "Mr. X" cannot overemphasize the importance of correctly filling in these forms, making certain that the man-

PERFORMANCE COUNTS
 wherever you are
 when it's a *Telrex*
CONICAL-V-BEAM
ANTENNA!

AMERICA'S OUTSTANDING TELEVISION ANTENNA

Whether you are located 2 blocks or 200 miles from the TV transmitter, there's a CONICAL-V-BEAM antenna designed to outperform all others... over 1,000,000 installations prove... performance counts.

Conical-V-Beams are produced under Patent No. 2518297.

® REGISTERED TRADE MARK

Telrex INC.
 CONICAL-V-BEAMS ASBURY PARK 5, N. J.

AMERICA'S STANDARD OF COMPARISON

..this letter speaks for itself!

Admiral Corporation
SERVICE DIVISION

201 S. NORTH WATER STREET • CHICAGO 11 • TELEPHONE ROYAL 6-4622

Mr. Mel Bushring
Simpson Electric Company
5200 West Kinzie Street
Chicago 14, Illinois

Dear Mel:

This is to tell you how delighted we are here at Admiral with the new Model 303 Simpson Vacuum Tube Volt-Ohmmeter. It certainly is a versatile instrument for television servicing.

The large meter is very legible, and yet the instrument itself is a compact size. I particularly like the AC voltage range, which is the widest I've ever seen on this type of instrument.

Our service engineers think you've done a good job on the Operator's Manual, too, because it is both complete and concise.

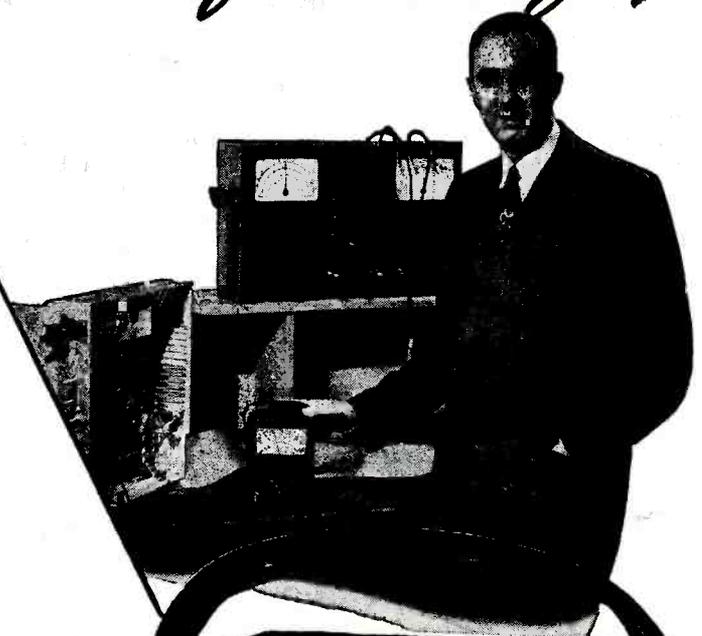
Of course, we've used the Simpson Model 260 Volt-Ohm-Milliammeter for years. The "303" is a fine companion instrument to the "260".

Congratulations!

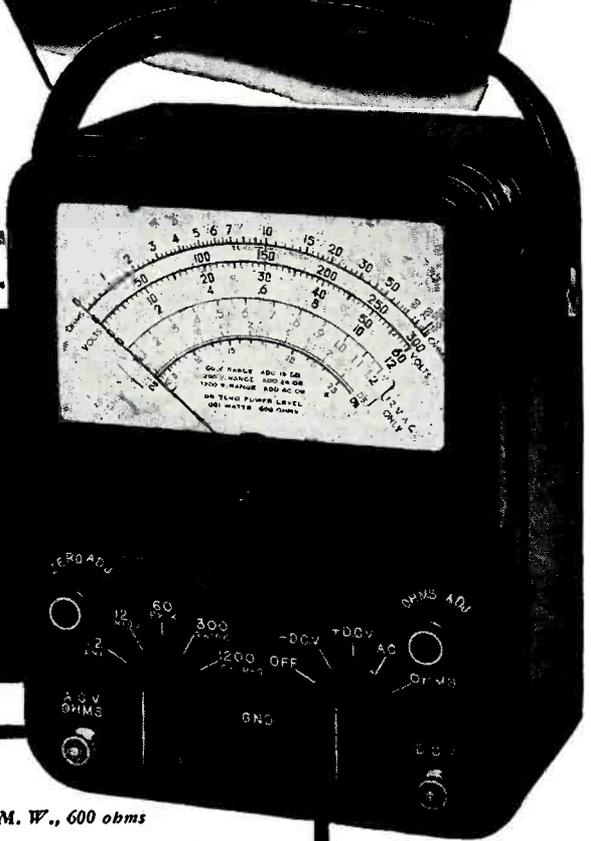
Sincerely yours,

M. J. Schinke
ADMIRAL CORPORATION
M. J. Schinke
National Service Manager

WJS:ar
WORLD'S LARGEST MANUFACTURERS OF RADIO PHOTODUPLICATIONS WITH AUTOMATIC REPRODUCTION
AB-18 Radios • Televisions • Tube Photographs • Circuits • Tube Testers



**Model 303
VACUUM TUBE
VOLT-OHMMETER**



SPECIFICATIONS

DC Voltage
Ranges 1.2, 12, 60, 300, 1200 (30,000 with Accessory High Voltage Probe)
Input Resistance 10 megohms for all ranges
DC Probe with one megohm isolating resistor Polarity reversing switch

Ohms Ranges 1000 (10 ohms center)
100,000 (1000 ohms center)
1 megohm (10,000 ohms center)
10 megohms (100,000 ohms center)
1000 megohms (10 megohms center)

AC Voltage
Ranges 1.2, 12, 60, 300, 1200
Impedance (with cable) approx. 200 mmf shunted by 275,000 ohms

AF Voltage
Ranges 1.2, 12, 60
Frequency Response Flat to 100,000 cycles

Decibels
Ranges -20 to +3, -10 to +23, +4 to +37, +18 to +51, +30 to +63

Zero Power Level 1 M. W., 600 ohms
Galvanometer
Zero center for FM discriminator alignment and other galvanometer applications

R. F. Voltage
(Signal tracing with Accessory High Frequency Crystal Probe)
Range 20 volts maximum
Frequency Flat 20 KC to 100 M.C.
105-125 V., 60 cycles

Size
5 1/4" x 7" x 3 1/4" (bakelite case). Weight: 4 lbs.
Shipping Wt.: 6 1/2 lbs.

Dealer's Net Price
Model 303, including DCV Probe, ACV-Ohms probe and Ground Lead—\$58.75;
Accessory High Frequency Probe, \$7.50;
Accessory High Voltage Probe, \$14.85
Also available with roll top case, Model 303RT—\$64.75

Simpson ELECTRIC COMPANY

5200 WEST KINZIE STREET, CHICAGO 44, ILLINOIS • IN CANADA: BACH-SIMPSON, LTD., LONDON, ONTARIO
Phone: Columbus 1-1221

ufacturers set model and serial numbers appear as well as the nature of the defect.

"Mr. X" also advises the service trade to hold weekly meetings of all personnel so that new circuit information can be presented and discussed. Many consumer relation difficulties can be ironed out through these discussions. Needless to say, service information in the form of "Hints and Kinks" pertaining to the peculiarities of individual models of many manufacturers' products can be passed between the various servicemen to the mutual advantage of the company and the men.

SPINNER

[from page 27]

3" x 3" x 18". A hole was drilled in the center of the block down the entire length. Three inches from the leading end, the block was turned down to an inch and a half. The turned area being 3" long. Next, it was split down the center and fitted with hinges so that it could be opened 'book fashion'. On the opposite from the hinges we attached luggage-type snap fasteners. On one side of the block near the trailing end, a spool for wire was mounted on a shaft. A

small coil spring was placed between the side of the block and the spool, the spring serving as a friction brake to prevent the spool from turning freely during operation.

The screw eye at the extreme end functions as a wire guide for the wire that will feed from the spool during the spinning process. Directly opposite from the wire spool, a counter-weight is attached. The wooden strips around the circumference of the 'Spinner' provide a guide for a continuous loop rope. A length of pipe 2-1/2" in diameter and 2" long was cut in half and hinged, and a screw eye welded to each half of the pipe opposite the hinge.

Construction then being completed, all that remained was the 'trial by fire'.

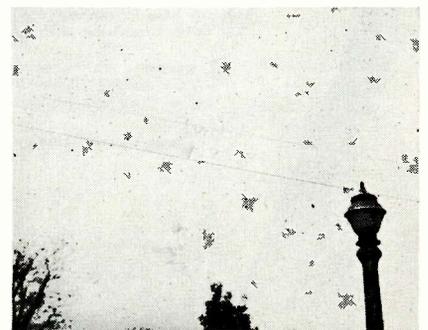


Fig. 3—Showing the messenger wire and the program line separated after removal of hemp cord.

After cutting down the old Hemp Cord, (see Fig. 3) we were ready for the respinning job. The procedure being as follows:

- 1—Load the Supply Spool with wire. (#21 was used)
- 2—Place the Spinner over the Messenger and Program Line.
- 3—Place the spilt pipe over the turned area, and put a single hand line through the two screw eyes.
- 4—With another length of rope, go around the Spinner once, (between the rope guides) and tie the two ends together, forming a continuous loop. (Be sure that both the single hand line and the continuous loop ropes are long enough to reach the ground.)
- 5—Thread the wire from the Supply Spool through the Wire guide and fasten it to the insulator on the pole.
- 6—The Cable Spinner is now ready for operation. (See Fig. 4)

Two men are required on the ground. One man pulls the Spinner forward by means of the single hand line, while the other man rotates the Spinner by means of the continuous loop rope. The speed with which the Spin-

[Continued on page 50]



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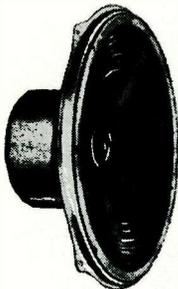
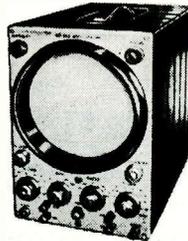
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TRADE FLASHES

[from page 14]

Ralph R. Shields, engineer for Sylva Electric Products Inc., stressed in an address at the Philadelphia Radio Servicemen's Association Convention at the Broadwood Hotel here recently.

"In factories producing more and more lower-priced TV sets of better quality," Shields said, "the answer is good test equipment. Good test equipment first proved its worth in engineering departments, later in production lines. The manufacturer's objective is the same as that of the TV serviceman, to satisfy the customer with the best results in the least time, every time."

Odorizzi Elected Operating V. P.

Election of Charles M. Odorizzi (shown below) as Operating Vice President of the RCA Victor Division, Radio Corporation of America, was announced today by Walter A. Buck,



CHARLES M. ODORIZZI

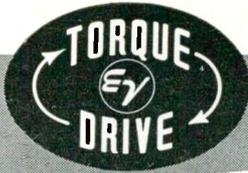
Vice President and General Manager of the Division.

Mr. Odorizzi has served since July, 1949, as Vice President in Charge of Service for the RCA Victor Division. In his new post, he will continue as chairman of the board of the RCA Service Company.

CIRCUIT COURT

[from page 37]

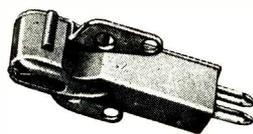
ployed in push-pull parallel connection. Note the use of 510 ohm isolating resistors between the grids of each pair. The grids are driven by a pair of 6J5 triodes and the secondary of the input transformer is split into two coils. This makes it possible to adjust the bias individually for each side of the stage. 47K ohm resistors dampen each secondary coil. Provision is made to minimize hum by adjusting the center tap on the 20 ohm heater potentiometer. All 2A3 filaments are connected to a single transformer winding.

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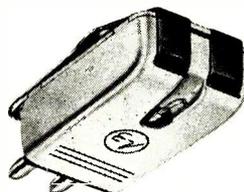
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ORTHOGONAL SERIES 32, 33 and 34

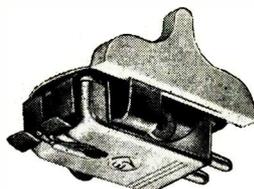
This TORQUE DRIVE* vertical-type crystal cartridge is being used more and more in original equipment and for replacement. The 32 series greatly improves 78 rpm reproduction—saves record wear. The 34 series for 33½ and 45 rpm beautifully plays the new wide-range, high fidelity recordings—tracks perfectly at 5 grams pressure. The 33 series handles all three speeds, with remarkable efficiency. All specially moisture protected for extra long life. Has ½" and ⅝" hole spacing. Color coded. Simple to install. Replaceable osmium-tip or sapphire-tip needles.

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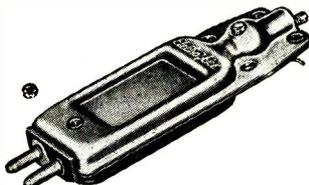
SERIES 12 and 14

The Series 12 TORQUE DRIVE crystal cartridge replaces over 150 types in general use for 78 rpm. Saves time and work—speeds servicing. Gives better reproduction and longer record life. Series 14 for 33½ and 45 rpm is performing brilliantly in thousands of record changers. Tracks perfectly at 5 grams pressure. Color coded. Replaceable osmium-tip or sapphire-tip needle.



SERIES 16 TWILT FOR ALL 3 SPEEDS

Superbly plays 33½, 45 and 78 rpm records with a single twin-tip replaceable needle without weight change, with tracking pressure of only 6 grams, and does it with TORQUE DRIVE efficiency. You merely tilt the Twilt and select the 1-mil or 3-mil needle tip for fast or slow speed records. Setdown is accurate. Mounts easily in most any standard pickup arm, with nothing more required than reducing needle pressure. Also available without tilting mechanism.



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[Continued from page 48]

ner is pulled forward and rotated will govern the spacing of the spiral winding. After a little practice it becomes an easy matter to spin a very tight and neat appearing cable in a very short time.

We found the Cable Spinner to be the answer to our problem, and can see uses for it in future jobs.



Fig. 4. Showing the Cable Spinner in operation.

On the job that the Spinner was used it was only necessary to bind one Program line to the Messenger, but with revisions on the Spinner, such as enlarging the hole down the center and using heavier wire on the Supply Spool, a number of wires could be bound to the Messenger.

TAPE RECORDERS

[from page 26]

to boost the low level signal to a practical workable voltage. Next, the signal output from this stage may be controlled by the variable resistor feeding the grid of the following 6SF5. Levels of post equalization derived from the RC networks in the output of this 6SF5 stage are variable at the one megohm resistor directly prior to entry of the signal into the standard amplifier as shown.

When we refer to the response curve for magnetic recording, as given in the Theory installment of this series, we see that a deficiency of lows is prominent. Therefore, when we consider the severe amplification required to build up these lows during playback, we realize that great care must be taken to eliminate the pickup of hum, 60 or 120 cycles, in the input circuits of such amplification. To this end Ampex has mounted their triple "Record-Erase-Playback" head above a shielding plate atop the

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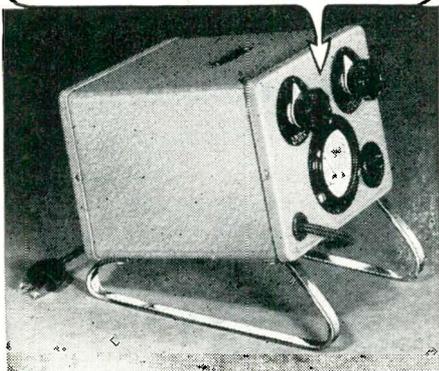
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entire machine. Other machines are similarly careful. Metal encasements of recording heads are grounded to shields so as to eliminate foreign induction such as hum which may originate from various sources.

Controls

There are many electrical controls required for the operation of tape recorders. Provision for rapid cueing and editing of program material is a prime requisite. Many machines offer such facility. A means of instant starting and stopping is necessary for machines used commercially. In the case of Ampex, when the takeup tension arm is moved into operative position it starts the capstan or main drive motor, provided the "Start" button has been depressed. Then the rubber idler impresses the tape against the capstan. This action brings the tape up to operating speed in less than 0.1 seconds.

When this same tension arm receives enough slack, when the tape runs out, or, in the event of tape breakage, the machine automatically stops, the takeup tension arm trips off the drive motor. Of course the machine may be stopped manually when the "Stop" button is depressed. Mechanical brakes insure quick smooth stops at any speed without undue tape tension. Editing operations are assisted by the feature which permits shuttling back and forth from a *rewind* to a *fast forward* travel of the tape.

Remote control is offered with this machine through relay operation. It is possible to start, stop and record this machine from remote locations once the tape is threaded.

Bias control should not be careless. Some tapes require different values of bias than others. For this reason some machines include a recessed screwdriver control of bias. Others ignore this feature.

Dual control of motor speed should be a permanent feature. It not only affords flexibility during recording, it also permits the playback of records made at different speeds.

Switchout elimination of all equalization is a desirable feature if the amplifier is to be put to other duties. Some instruments include switching of equalization coincidentally with mechanical switching from "Record" to "Playback." Others incorporate an automatic change of equalization for any change of speed of tape transport. All these features are necessary for better performance.

All machines include some means of level indication during recording.

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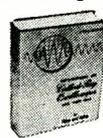
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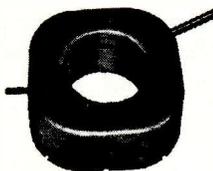
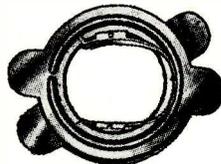
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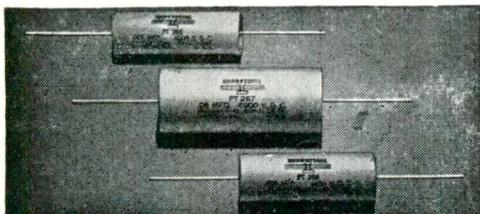
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Some use meters. Others use neon lamps. It is important that the recording level be adequate to override ambient noise. It is equally important that overloading does not take place. The latter will cause partial erasure of the signal due to fringing flux spewed out from the poles.

FRONT ENDS

[from page 24]

vided to allow for more flexible tuning. This extra coverage is sometimes called "overtravel."

A 3-section variable condenser is used for tuning the first r-f plate circuit, the second r-f plate circuit, and the oscillator.

Summary

To summarize briefly the contents of this installment, tuners may be divided into four main types. These are, 1) individual coil, 2) tapped coil, 3) variable inductance tuning, and 4) variable condenser tuning. Methods of band switching using individual coils are, 1) turret tuning, and 2) wafer-type rotary switching.

With tapped coils, wafer-type rotary switching is employed exclusively. With variable inductance tuning the frequency is varied continuously by varying the inductance of a coil. With variable condenser tuning the frequency is varied continuously by varying the capacity of a variable condenser. The use of an dedent mechanism with variable condenser tuning merely enables the operator to switch to a desired channel quickly; however, the tuning is still continuous.

CRT

[from page 22]

trol is necessary for balanced positioning voltage. Since the electron stream is negative, it will move toward the more positive plate and away from the more negative plate. In order to provide balanced positioning, and to prevent defocusing, one plate must increase in value, or go positive while the other plate decreases in value, or goes negative. By means of this criss-cross of connecting wires, the two sections of the ganged control are connected in the opposite sense. This means the left hand extreme of R-111B is the -120 volts while the right hand limit is the positive 100 volts.

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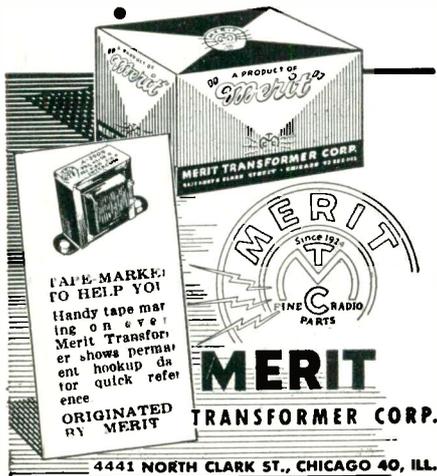
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Positioning is obtained by rotating this control on the front panel of the oscilloscope. Clockwise rotation of the control if we assume it to be from left to right in the drawing, moves the electron stream up the fluorescent screen face. When this control is moved clockwise, or to the right in the drawing, the vertical deflection plate connected to *pin number 8* goes more positive, since the potentiometer arm is moving toward the plus 100 volt side.

At the same time, because these controls are ganged, and operate together, the other control is moving toward the right hand extreme which is -120 volts in this case.

Thus the vertical deflection plate connected to *pin number 7* has a more negative voltage. Under these conditions, the plate going to *pin number 8* becomes more positive and the electron stream tends to move upward toward this positive voltage. At the same time, the opposite plate, going to *pin number 7* is the lower plate and has an increasingly negative voltage which repels the electron beam and also forces it to move in an upward direction. This is commonly known as balanced positioning voltage since half of the total effect is obtained from each of the plates being used together. The positive 100 volt used for positioning is obtained from its tap on the output of the low voltage supply; the -120 volt tap on the high voltage supply provides the negative voltage used for positioning or centering. The deflection plates are never more than 120 volts below or 100 volts above ground potential which is the accelerating anode. In this manner, they do not cause any defocusing.

The horizontal or X axis circuit has a centering system which is almost identical. The part values are the same and the ganged *Horizontal Beam Centering Control* is on the upper right hand corner of the front panel of this instrument. Clockwise rotation of this control moves the electron beam to the right or toward the more positive plate and away from the more negative plate. If we assume that clockwise rotation is from left to right in the drawing, potentiometer *R-123B* will be at its most positive value at the extreme of right hand travel and is applied to the horizontal deflection plate connected to *pin No. 11*. At the same time, the opposite deflection plate is at its maximum negative value in the same position of the control. These positive and negative voltages aid each other in controlling the horizontal motion of the electron beam.

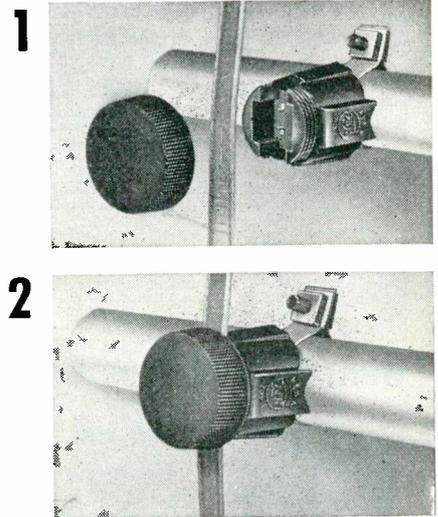
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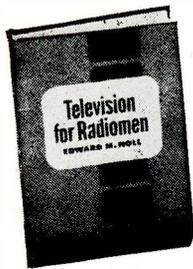
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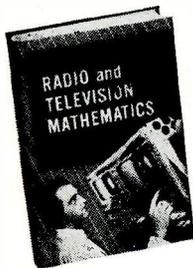
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TIME MULTIPLEX TRANSMISSION

[from page 18]

at the transmitter. It would, of course, have to be carefully synchronized to be certain that the sampling action would occur at the crest of the incoming sine wave. Receiver sampling process forms another group of pulses like those that were formed at the transmitter. This group of pulses is applied through an amplifier at the receiver which has an upper frequency limit somewhat higher than the highest audio information to be conveyed (assumed to be 10 kc in our example). Here again the amplifier is acting as a low pass filter, pulse frequencies being filtered and filled-in to form a sine wave that corresponds to the original audio variation of the transmitter, *Fig. 1.*

Sampling Requirements

Three factors that determine the operational characteristics of a sampling system are:

1. If the frequency to be sampled is higher than the sampling rate, information will be missing, as illustrated in *Fig. 4.* It is obvious if the sample rate is low the fast variations present will not be sampled and, therefore, cannot appear at the receiver.

2. To convey a higher frequency, it is necessary to make the sampling rate higher also. Thus the sampling rate is a function of the highest frequency to be conveyed. If 10,000 cycle audio is to be the highest frequency to be sampling rate must be approximately double this value. If a sampling rate would have to be substantially higher than the highest video frequency present.

3. Sampling rate must be at least double the frequency of the highest frequency information to be conveyed. Actually, the sampled sine wave which is varying in amplitude contains the fundamental sampling rate sine wave plus upper and lower sidebands. The low frequency side band, of course, must not be present in the band of frequencies which are to be conveyed as it would contribute an additional signal other than the desired one. For example, if the sampling rate is 20 kilocycles there is a 10 kc side band and a 30 kc side band. The 10 kc side band is at the very end of the limit of the high frequency information to be conveyed. If the highest frequency to be conveyed were a 2 megacycle video component, the sampling rate would have to be at least 4 megacycles.

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Multiplex Sampling

Observation of the pulses and sampling sine wave output in *Fig. 3* shows there are definite areas between pulses during which time no information is conveyed. Likewise, there are intervals during which the sampling sine wave is passing through or below zero at which time it could be quite possible to sample still other signals. For example, as shown in *Fig. 5*, it is possible to send an entirely separate signal than the single 5,000 cycle example given. Suppose it was necessary to send another 5,000 cycle note (illustrated in red) would also be sam-

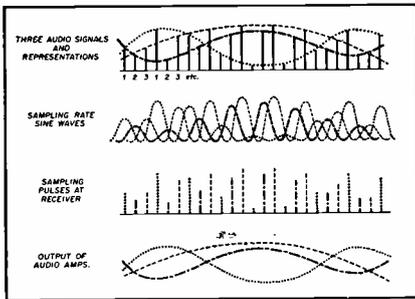


Fig. 5. Multiplex Audio System

pled at the same rate of 20 kcs but would be sampled at a point one-third of the spacing between any two of the previous green sampling positions. Thus a new group of sampling pulses would be formed which, when passed through the amplifier, would be formed into a sampling rate sine wave which would rise to its crest value at the same instant the previous green sine wave were below zero.

Thus the amplitude at the crest of the red sine wave would be indicative of the variations of the original red information and would not, in any way, be influenced by the information illustrated in green.

Still another signal could be conveyed without interaction. For example, let us assume that the information represented by the blue signal was to be conveyed simultaneously. For this case, it must be sampled again at the same rate of 20 kc at two-third spacing position between the green samples. A new set of pulses are formed which follow the information illustrated in blue. The pulses illustrated in blue would also revert to a sampling rate sine wave, the crest of which occurs when the other two sampling rate sine waves are down at zero. Again the new sine wave crest amplitude would be indicative of only the information sampled and illustrated in blue.

A composite signal made up of the three sampling rate sine waves but

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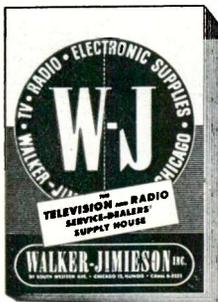
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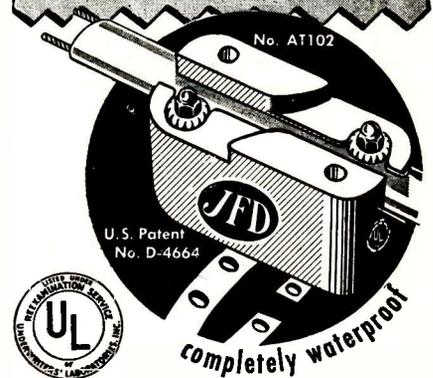
having no frequency variations higher than the sampling rate would be used to modulate the r-f carrier. At the receiver, this composite wave would be demodulated and the various segments of it sampled at the same rate and in the same sequence as the original information was sampled at the transmitter. Sampling action would again produce three separate pulse groups which would be sent into three separate audio channels, in the same sequence as they were formed at the transmitter. Thus, three separate and segregated audio outputs are obtained at the receiver and a loud speaker or any reproducing device could be switched at will to any one of the three outputs.

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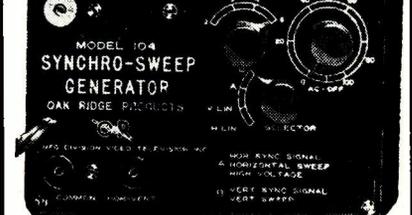
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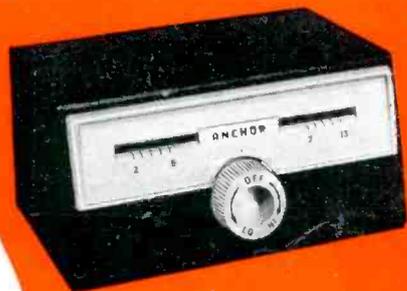
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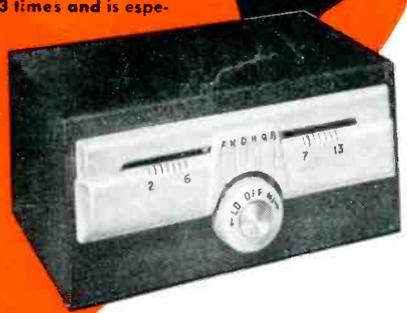
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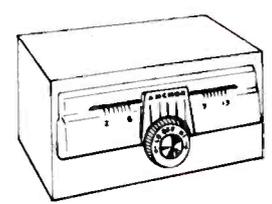
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